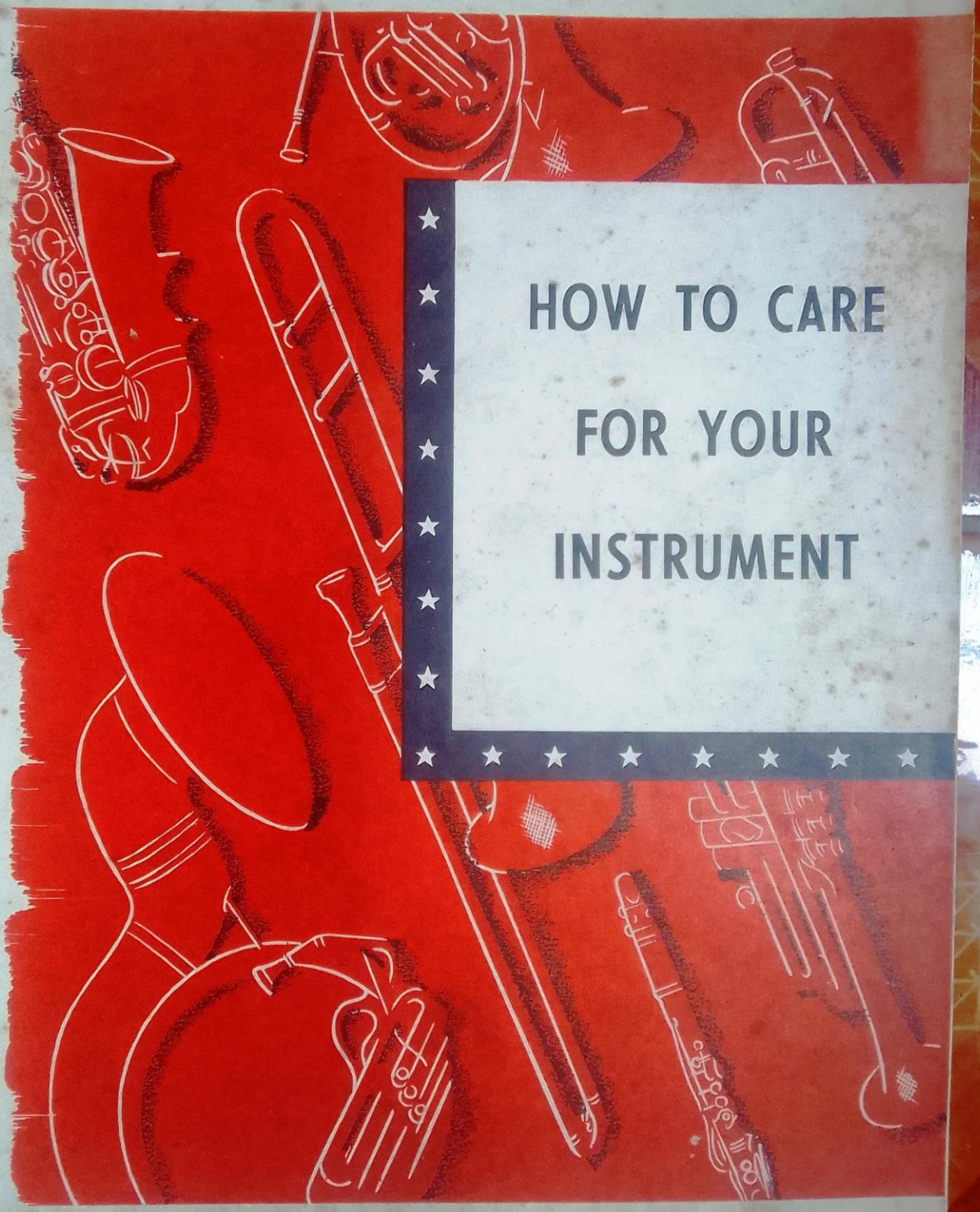

HOW TO CARE FOR YOUR INSTRUMENT

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How to Care For Your Instrument

Importance of Keeping Your Instrument Dry and Clean

Moisture. Corrosion on brass and nickel silver or rust on iron and steel is the result of a chemical reaction called oxidation. This chemical reaction does not take place except in the presence of moisture. This fact should make quite clear the importance of keeping instruments dry. Wood instruments must be kept dry to prevent checking and cracking. When the wood is cured, excess moisture is taken out. Absorption of moisture followed by evaporation of moisture disturbs the grain structure and causes the wood to split.

Body Acids. Perspiration from the hands contains certain acids which attack metal. Among these are butyric, lactic, and traces of hydrochloric. Some perspiration is alkaline but is just as harmful as acid. In some persons the perspiration is such that holes are eaten right through plating and brass wherever the bands are accustomed to touch the instrument. Keep your instrument free from perspiration. Use a leather valve protector or a cloth or some other device to keep perspiration from your instrument and wipe off all perspiration after using it.

Saliva from the mouth also contains acids which attack metal. Carbonic acid is present at all times in saliva and other acids are formed in the mouth, depending on food eaten and hygienic conditions of the mouth. Soft solder is especially subject to the effects of saliva acids. Water key nipples which are soft soldered will be eaten out entirely. Although most of the better saxophones no longer use soldered sockets, saxophone tone hole sockets which are soft soldered will become loose and leak. That is why the inside of instruments must be cleaned often and thoroughly.

Salts. Not only in saliva but in natural well or spring water there are certain salts that dry as a white substance on the pistons and slides and act as abrasives, causing the action to be retarded and wearing away the precious coating of nickel and chromium. These salts are chiefly magnesium and calcium carbonates and sulphates but there are also appreciable amounts of chlorides of sodium, potassium, magnesium, and calcium. In certain parts of the country these salts are present in the water in greater quantities than in other parts. Water which is said to be "hard" — that is, does not make a good soap lather — has a high content of these salts. Those who prefer water to oil for new piston and rotary valves would do well in such localities to use distilled water. After using the instrument, be sure all saliva and water are wiped off pistons and slides.

Foreign Matter Impairs Acoustical Performance. A surprising amount of food, candy, and other stuff accumulates in a wind instrument if it is not systematically cleaned out. It is often referred to by professional musicians as "hamburger" or "lungs," but whatever you call it, it is filth that you should get rid of and keep rid of. Not only is it unhealthful, but it impairs the acoustical performance. It collects especially in crooks, and is usually the cause of instruments becoming "blown out of tune." If one of these accumulations occurs at a "node" in the wave of a certain tone, this tone sounds sharp. If an accumulation occurs where an "antinode" falls, the tone is flat.

Conn once received a trombone which the owner said blew all right when he first bought it but after awhile it became "blown out," as he said. It lacked power and punch, and the scale was not exact and definite. This musician seemed to think that there was something wrong with the brass of which the trombone was made and that it had in some way lost its "temper" or tone quality. Apparently the instrument had never been cleaned out since it had left the factory, for over two cubic centimeters of filth was taken out of it. This was a lump about the size of a wad of chewing gum. After being thoroughly cleaned, it blew like new. Nothing else was done to it except give it a plain, old-fashioned bath in soap and water.

Reed instruments also suffer in acoustical performance from accumulation of foreign matter. Tone holes are often partially closed by dirt, especially the small register holes. Clarinets with "bad B♭" or that "don't respond in the second register" all too often have the little metal tube register hole nearly plugged shut with dirt and oil, caused by swabbing the inside bore.

Foreign Matter Impairs Mechanical Action. Corrosion, as well as salts and other foreign matter, accumulates on piston valves. Valves with such accumulation will not work. It may not seem like much, but valves are fitted tightly and a little dirt between the piston and the casing is like a speck of dirt in your eye.

Here is the story, as shown by a typical case of "faulty" valves. When the instrument came in, the clearance between the piston and the casing of each valve was checked while they were dirty — before cleaning. Clearance was also checked after the valves were cleaned. The clearance for the three valves before and after is shown below:

	No. 1	*No. 2*	*No. 3*
Clearance dirty	.0012″	.0011″	.0013″
Clearance clean	.0016″	.0015″	.0016″

The clearance while dirty was 12, 11, and 13 ten-thousanths of an inch, or a little more than the thickness of a cigaret paper! When cleaned, the valves had a clearance of 16, 15, and 16 ten-thousandths of an inch, or a little more than the thickness of a cigarette paper plus one-half the thickness of another cigarette paper. Since .0012″ (12 ten-thousandths of an inch) is the very minimum clearance for *clean* valves, you can imagine how the first and second valves worked — especially the second. Cleaning took .0004″ (4 ten-thousandths of an inch) off the first two valves and .0003″ off the third. This is only 1/8th to 1/10th of the diameter of a hair, but it was enough to transform good working valves into valves which wouldn't work at all. Modern tight-fitting valves have to be *kept clean* to get out of them the light, fast action which the manufacturer builds into them.

Corrosion and dirt also affect the action of other working parts, such as valve slides, hinges, pivot screws, cams, needle and flat springs. The only way to preserve and keep your instrument in tip-top working condition is to keep it "clean as a pin" and properly oiled and lubricated.

Suggestion to Bandmasters on Mass Inspection of Instruments

To guard against stuck slides and valve caps, swelled tenons and loose rings, some bandmasters hold mass inspections periodically or delegate this duty to section leaders. Valve instrument players are lined up as if for military inspection. At the command, "Pull 1st valve slides," all players are expected to pull the first valve slide from their instruments. These slides are then inspected for corrosion and proper lubrication. The player who has difficulty pulling the slide is advised to do something about it before the slide becomes stuck so it must be taken to a repairman.

The same procedure can be followed for all valve slides, tuning slides, demountable bells, valve caps, finger tips, mouthpieces, and certain mechanical parts. On woodwinds an inspection can be made of tenons, bell and joint rings, ligatures, and protectors for flute and oboe slides and joints. Percussion and string instruments could be inspected in same manner.

PISTON VALVE INSTRUMENTS

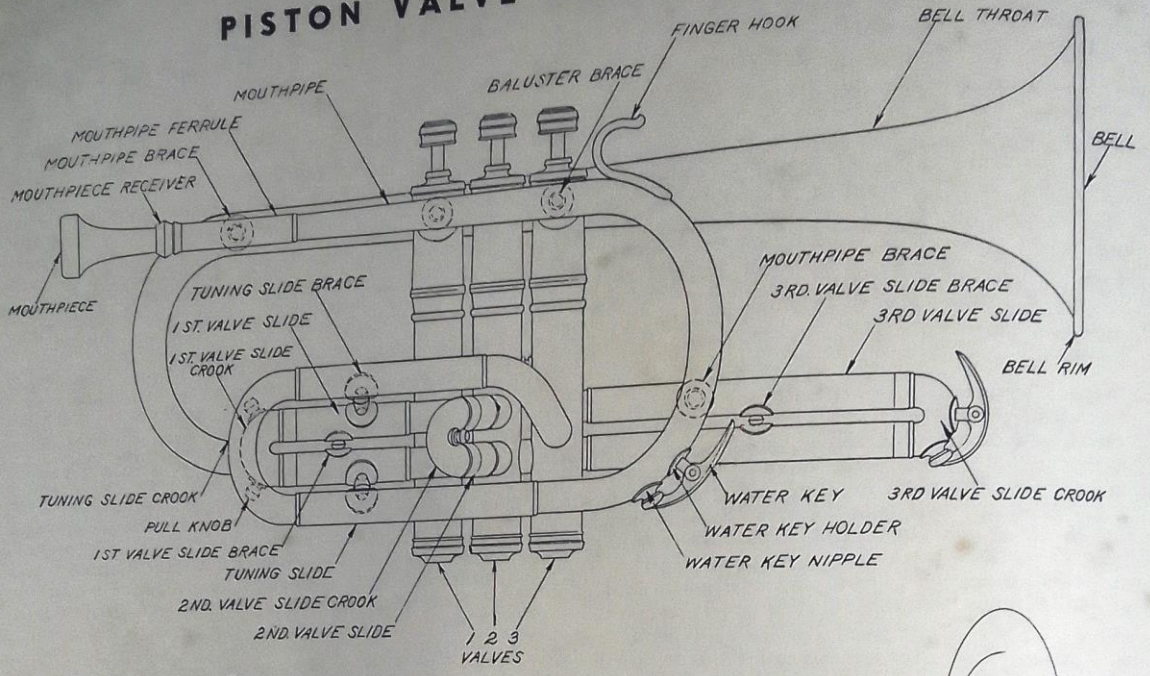

Fig. 1 — Cornet. Parts on trumpet and fluegelhorn are similar.

Cleaning Valves. Remove the pistons, wash them and the inside of the casings with castile or Ivory soap and warm water, and rinse in clear water. Be careful in handling the pistons that you do not drop or strike them against objects, as they are hollow and dent more or less easily. Wipe the pistons dry with clean cheesecloth and lay them on a clean cloth so they won't pick up grit or dust. Then swab the inside of the casing with clean cheesecloth, using swab supplied with the instrument, or a weighted string. If you use the metal swab, be sure you do not gouge the casing wall with the end of the swab. Keep end covered with the cheesecloth. See Fig. 3 on how to do it. After cleaning, dip the pistons in clean, cold water and replace in the casings.

Be sure you get No. 1 piston in No. 1 casing, No. 2 piston in No. 2 casing, and No. 3 piston in No. 3 casing. This obvious point is stressed because it is so often a cause of trouble. The interchange of pistons one and 3 will still permit the instrument to be played but it will blow stuffy and will be out of tune. No. 1 casing is nearest the mouthpiece and No. 3 casing is nearest the bell; the pistons are numbered, usually on top; so there is no excuse for getting them mixed up.

Sometimes the valve caps are also numbered 1, 2, 3, and if so be sure to avoid getting them mixed up, as they are liable not to be interchangeable. On Conn Clickless valves, the valve caps are numbered inside and should be properly replaced, No. 1 on No. 1 valve, etc.

On valves of the key-in-keyway type (See Fig. 4) be sure you have the key properly started in the keyway before you push the piston down or the key and keyway may be damaged. In the spring barrel type valve (See Fig. 5), where various shapes and sizes of piston guides fit into slots in the upper end of the valve casting, be sure these guides are in their proper slots before you screw the top valve cap down. Sometimes these guides consist of 3 points irregularly spaced and sometimes they consist of one large and one small point. The reason for these designs is so the

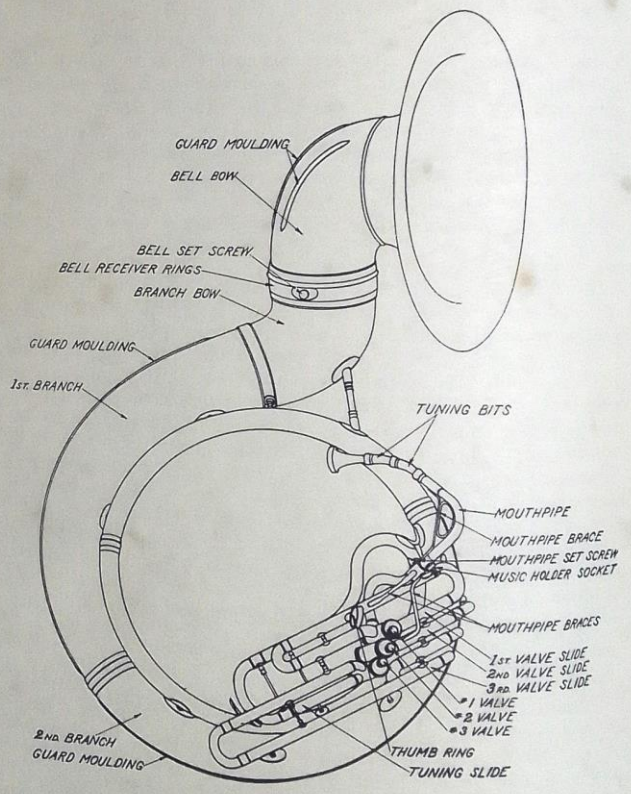

Fig. 2 — Sousaphone. Parts on bass tuba, baritone, euphonium, and alto horn are similar.

points of the guides will drop into the slots in the upper end of the casing in *only one position*, insuring proper radial location of ports in the piston with reference to knuckles in the valve casing.

On Conn's Clickless valves (See Fig. 6) there is a locating key in the pin head which determines the radial position of the piston; this fits into a short slot in the upper end of the casing, insuring that the ports and knuckles meet accurately. While the pistons and valve caps

are not interchangeable and must be replaced carefully according to the number each bears, the pin heads are interchangeable. Be very careful in handling these pin heads that the pins do not become sprung or bent, for this will impair smooth valve action. If a pin does become bent or damaged, don't try to repair it; get a new pin.

Replacing Cork and Felt Bumpers. Putting on new cork and felt bumpers is really a job for an experienced repairman, but in an emergency you may have to do the job yourself. If regular cork bumpers are not available, one can be made from an ordinary bottle cork. On Conn Clickless valves, be sure to glue on cork and felt with a glue not readily soluble in water, or saliva will soak them loose. Avoid getting any glue on the piston or casing walls, and be sure the slot in the cork and felt is centered so the pin will move up and down freely in this slot without touching.

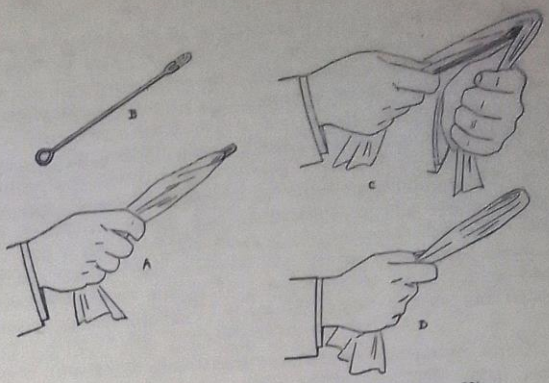

Fig. 3 — How to cover swab for valve casing. View (A) shows how NOT to do it. Even though corners of "eye" are rounded, they are liable to scratch and gouge the sidewall of the casing. Some repairmen break off the eye, as shown in view (B), the better to hold the cloth. Views (C) and (D) show two steps in covering swab so all metal is shielded by cloth.

Most valve stems are marked to indicate just how high the bumper and felt should be to allow the piston to come up so that the ports in the pistons accurately meet the knuckles in the casing. If there is such a mark on the valve stem, it is easy to cut the cork so the piston will stop at the proper place when the finger releases it. Keep shaving or sanding off the cork until when you sight across the top of the valve cap, the mark on the valve stem is level with the top of the valve cap; then you know the cork and felt are the proper height.

If there is no such mark, you'd better let an experienced repairman do the job. It is extremely important that the height of cork and felt is correct; otherwise the ports in the piston and the knuckles in the casing will not meet accurately, and the instrument will blow stuffy and will lack resonance.

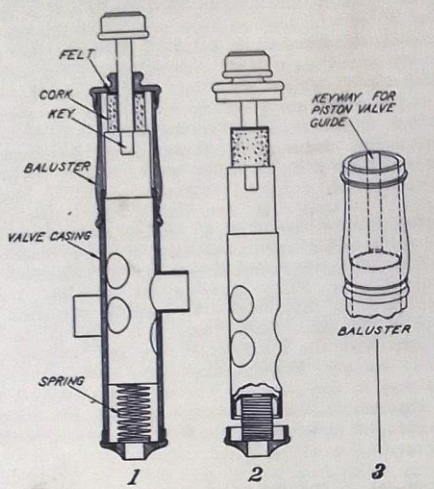

Fig. 4 — Key-in-keyway type of valve. View (1) shows position of parts when piston is up; view (2) shows position when piston is down. View (3) shows slot or keyway in baluster. Key in piston rides in keyway as piston is worked up and down. This key keeps piston from turning radially, maintaining proper match of ports in piston with knuckles in casing.

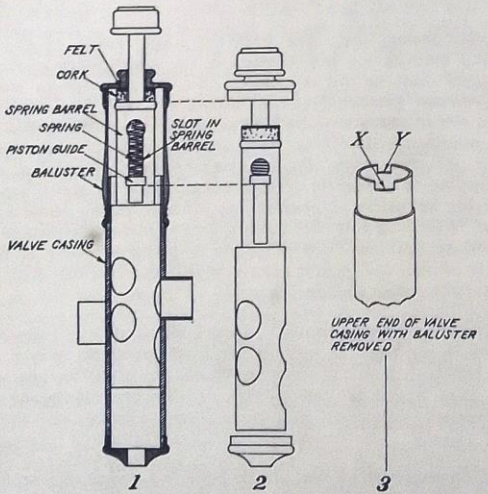

Fig. 5 — Spring barrel type of valve. View (1) shows piston up; view (2) shows piston down. Note piston guide remains stationary. Ends of guide remain fixed in slots (X) and (Y) in top of valve casing. View (3) shows wide slot (X) and narrow slot (Y). Some valves of this type have 3 ends or "points" on piston guide, sometimes called "star." Piston guides obviously can go in slots only one way; this insures that ports in piston match knuckles in casing.

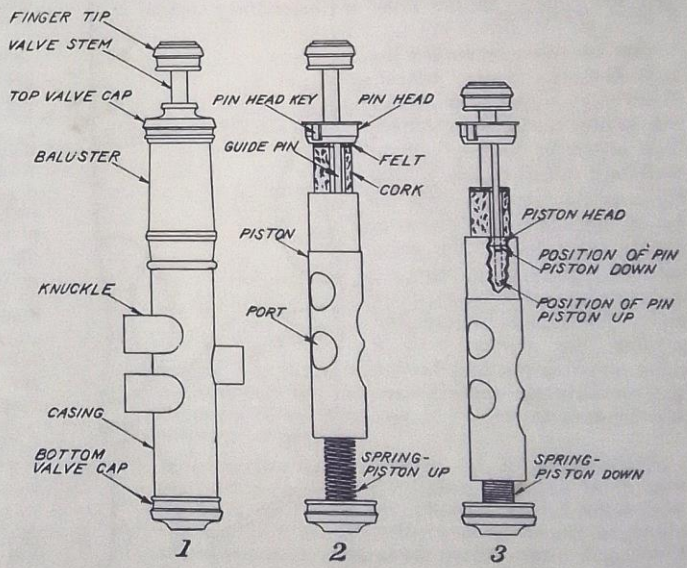

Fig. 6 — Conn Clickless valve. View (1) shows outside of casing with piston up, while view (2) shows piston up but casing cut away. View (3) shows piston down. Note pinhead remains stationary, a flange of the pinhead resting on top of casing and held tight there when top valve cap is screwed down. The key in pinhead fits in short slot in inside of casing wall so it can't turn radially. As piston is worked down and up, pin through top of piston guides piston so it cannot turn and so ports in piston match knuckles in casing.

Lubricant. Before putting pistons back in casing, be sure there is no lint left in the ports or later this will come out and foul the action. Also, before putting the pistons back in casings, place a few drops of oil on the pistons. Use a light, high grade valve oil. Conn valve oil was developed especially for this purpose. Many players get good results by putting a few drops of oil on the piston, then running cold water over it and working it into the casing. Some players prefer to use water or saliva on new, tight-fitting valves, but generally speaking a fine oil is best. On valves which are worn, a heavier oil can be used, as this heavier oil helps seal up the excess clearance which has worn between the walls of the piston and casing.

Conn piston valves are very accurately fitted with clearance from .0012" to .0018" (one and two-tenths of a thousand to one and eight-tenths of a thousandth of an inch). The clearance on a side is just half this, or about .0008" (8 ten-thousandths of an inch) or ¼ the diameter of an average human hair. This does not leave much space for the film of oil, but a fine grade of oil will work all right. Valves that wear until the clearance reaches .0025" to .003" are liable to leak. Only a heavy oil which helps close up the excess clearance will make them playable.

Corroded Valve Caps and Pistons. An instrument not properly cleaned and oiled will corrode after months of disuse. Valve caps will stick and cannot be unscrewed. Don't use strong-arm methods to loosen them. Don't use pliers or pipe wrench, for you'll mar and break the instrument. Sometimes tapping with a wood mallet or wood hammer will be enough to break the corrosion loose sufficiently that the cap can be unscrewed. Sometimes a liberal bath of kerosene left overnight will loosen the cap. If these more gentle methods fail, take the instrument to a good repairman.

To remove a corroded piston is even more difficult. Don't try to poke the piston out of the casing with a stick. The piston is *hollow*, and the walls are thin. See Fig. 7. This force is liable to stave in the top or bottom of the piston or buckle the sidewall. Put kerosene or a good penetrating oil in the valve and let it sit overnight. Then try pulling and pushing the piston with a slight rotating motion. If this does not bring success, see your repairman.

Before putting an instrument away for any length of time, apply a little vaseline or tallow to the threads of the valve caps; also a little valve oil on the piston. This will help avoid corroded caps and pistons and will help preserve your instrument.

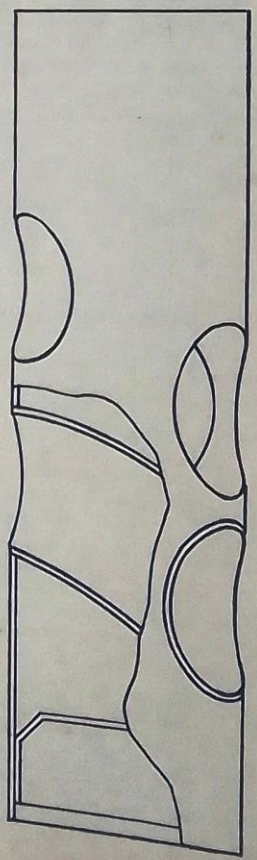

Fig. 7— The piston is a hollow shell. The holes through the piston are short lengths of smaller tubing which furnish the air passage from one side to the other. These pieces of tubing are inserted through holes in the sidewall of the piston and are brazed flush with the sidewall.

Cleaning Valve Slides. If valve sildes are stuck, don't use strong-arm methods to get them loose. The result of force is usually a broken brace or a kink in the valve casing. The best method of starting a valve slide not too badly corroded is to put a piece of cloth (a handkerchief will do) through the slide and give it a quick jerk. If this won't do it, try some kerosene on the slide and let it stand overnight. A slide which resists all such efforts should be taken to an experienced repairman.

Once the slides are removed, clean off all corrosion with gasoline or the metal polish you use for cleaning the outside of your instrument. Do not buff the slides or you will soon wear the slides down until the fit will be too loose and the slides will drop or blow out. Wash the inside with castile soap and warm water. Fill the slide half full of soapy water and shake well. A weighted string and a piece of cheesecloth about 3 to 4 inches wide and 3 to 4 feet long will enable you to remove dirt from the slide crook which you might not otherwise reach. See Fig 18 for illustration of this cleaning device adapted to trombone slides. When the slides are thoroughly washed, rinse them in cold water.

Mutton tallow, vaseline, or cork grease should be put on the valve slides before putting them back in the instrument. This will prevent corrosion, make them work freely, and retard wear. After applying the lubricant sparingly, lap each side in individually by pushing the slide in and out and at the same time giving it a rotating movement. This distributes the lubricant evenly and thoroughly over the slide surface. Finally, push both sides of the slides all the way in and wipe off excess at the joint. This prevents the excess lubricant from getting into the valve slides and then into the valves, where it will literally "gum up the works."

Never try to remove or replace a slide unless the corresponding valve is open; that is, unless the corresponding piston is pushed down.

Examine the water keys. A thin coating of oil will help prevent rusting of the spring. If the cork is defective, supply a new one.

Cleaning Mouthpiece. The greatest single cause of damage to cup mouthpiece instruments is the mouthpiece corroded or stuck fast in the mouthpipe. In the attempt to loosen and remove the mouthpiece, braces are torn loose, mouthpiece receivers are pulled away from the mouthpipe, and the mouthpipe itself is bent and broken. If the mouthpiece becomes stuck, don't go beyond gentle methods, such as tapping the receiver with a wood mallet or wood handle, applying kerosene or penetrating oil and letting stand overnight. When tapping the mouthpiece receiver, lay it against something solid, such as table top or block of wood. If these gentle efforts fail, you'll save yourself costly repairs by letting a repairman do the job.

The mouthpiece should be kept clean all the time. The throat is the critical spot in the mouthpiece as it does not take much dirt in this narrow throat to spoil the performance. See Fig 8 to get an idea of this narrow throat and the construction of mouthpipe receiver, ferrule, and mouthpipe.

Good mouthpieces should be kept in a pouch or bag. This protects the rim from dents and the thin edge of the stem from becoming mashed. It also cultivates the habit of removing the mouthpiece after every performance.

Never put your instrument away at the end of the season with the mouthpiece left in. If you do, much trouble awaits you when you pick it up again.

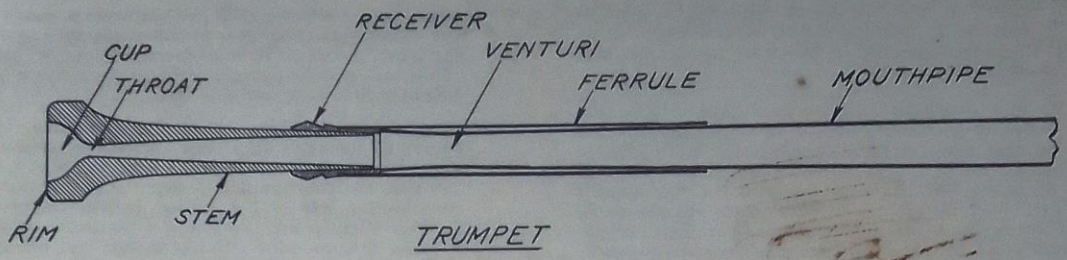

Fig. 8 — Trumpet mouthpiece and mouthpipe. The throat of mouthpiece and venturi of mouthpipe are the critical spots and must be kept clean. Avoid forcing cleaning rod through these passages which will enlarge them, for this will damage the response of instrument. Note frail construction of receiver. If mouthpiece becomes corroded and stuck, don't use strong-arm methods to loosen it or you will break receiver loose.

Cleaning Inside Tubing. Dissolve some castile soap in warm water. Pour this into the bell, working the valves so the solution will pass through the valve slides. This will loosen corrosion and dirt which may have been blown into the instrument. After this has been done, the inside of the instrument should be rinsed in cold water, either by pouring it into the bell or with a hose and a reducing nozzle to fit the mouthpipe. If you use latter method, avoid excess pressure; a medium flow is sufficient. This process of cleaning the inside of tubing should be followed by thorough cleaning of valves and valve slides, to remove from these parts any dirt dislodged from the interior of the instrument.

Avoid poking swabs down mouthpipe and be careful if you use a weighted string, for inside the mouthpiece receiver and ferrule is a more or less delicate mouthpipe which must not be damaged. See Fig. 8.

Cleaning Outside. For lacquer finish, use Conn Lacquer-Life or similar lacquer cleaner and preservative. Liquid wax is also used to protect lacquer finish but be sure to rub with soft cloth until all stickiness is removed. Mild soap and water or simply a damp chamois can also be used. Avoid using special cleaners with alcohol in them, for this will take the lacquer off. Avoid use of abrasives.

For plain polished brass (not lacquered), chromium, nickel silver, or nickel plated finish, a simple but satisfactory cleaner can be made by mixing a tablespoonful of fine grade whiting in a half glass of denatured alcohol. Stir the whiting well, apply lightly, and rub off carefully when dry. Be sure to use a *soft* piece of flannel for this purpose, as other cloth is liable to scratch.

For silver, use a high grade silver polish, in paste or liquid form, or the whiting mixture described above.

For gold, use rouge and a piece of *soft* flannel. Gold is easily scratched, so be especially careful in cleaning an instrument in gold finish.

Be careful not to get any of the cleaning materials inside the valves or slides. Use cleaning materials sparingly and wipe them off carefully.

Lacquer is a good preservative for all metal finishes. Clear lacquer applied over silver, gold, nickel, nickel silver, or chromium protects the plating or metal from the attacks of acids in perspiration without changing the color or appearance of the finish. "Gold" lacquer is usually applied over brass so it looks like gold. Lacquer has been improved until it ordinarily has quite a long life. This does not apply to certain individuals who "go through" lacquer in a few days. There is so much acid in their system that it eats the lacquer away quickly and even eats into the metal.

Tips on Avoiding Trouble. In the foregoing we have made several suggestions on how to avoid trouble. Here are a few more, taken from the experience of both professionals and amateurs. Some of these tips may seem trivial, but it is some of these "trivial" things which cause big troubles.

1. Don't chew gum or drink Coca-Cola and other "soft drinks" while playing. Sugar from the gum and soft drinks will be blown into the instrument, causing the valves to stick. Don't smoke while playing, or tobacco particles will be blown into the instrument. After eating candy or food, rinse the mouth thoroughly with water before playing your instrument. The reason is obvious.
2. Don't pick up instrument by grasping it near the end of the valve slides or tuning slide. See Fig. 9. At this point the leverage on the valve slides is greatest and the slides are liable to become sprung. Not only that but this leverage on the slides often puts a buckle or dent in the valve casing to which they are joined. It takes only a slight dent here to rub on the piston and cause the valves to drag. If you don't believe what we're telling you and you want to run the risk of damaging your valves, try this test: Push the third valve down, then grasp your third valve slide and apply a little pressure. This slight pressure will buckle the valve casing enough to bind the piston so it will not come up. Every time you pick the instrument up in this manner and squeeze the valve slides, you buckle the valve casing — and then you wonder why the valves give trouble. Pick up cornets and trumpets by their valves. Pick up larger instruments by thumb ring, one of the larger branches, or other well-braced part.

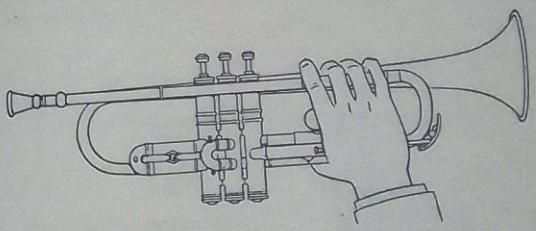

Fig. 9 — How NOT to pick up your instrument. Don't put pressure on valve slides or tuning slide, or you will put a kink in the sidewall of the casing. Pick up your trumpet or cornet by the valves.

3. When holding the cornet or trumpet in playing position, don't put pressure on second valve slide with the right hand. This puts a strain on the valve slide, which in turn puts stress on the valve casing, causing the same trouble pointed out above.
4. Don't lay your instrument down so stress and strain are put on any of the valve slides. This is especially important in the larger instruments, such as basses and sousaphones.
5. Check up on the latch of your case to be sure it is holding properly. Such care may avoid a bad spill and damage to your instrument if the lid should fly open.

6. Tie down or box mouthpiece and other accessories in the case so they can't bang around loose. Many a bad dent, especially in the valve casing, has been caused in this manner.

7. Be sure your case is properly blocked to give protection to your instrument in the event the case and instrument are dropped or something is dropped on them. Usually a case made by the manufacturer of the instrument has been designed for this specific instrument. Beware of "special" cases made to fit all instruments. Also beware of second hand cases originally made for other instruments. They often support the instrument where it should not be supported and do not support it where they should.

8. Don't force lid shut on a case crammed with music and other stuff. You run a big chance of springing slides and jamming the valves. And don't use your case as a seat; it isn't built to withstand such usage.

9. Don't use rubber bands to hold water key shut, except in an emergency and temporarily. Sulphur in the rubber will tarnish silver and brass and eventually will eat into the metal. Any rubber article, such as rubber mouthpiece, will tarnish silver if left in the case unwrapped.

10. A piece of camphor gum absorbs moisture and is often carried in the case with the instrument to absorb moisture and retard tarnish or corrosion, especially in summer when humidity of the air is high.

11. When you put your mouthpiece in your instrument, don't hit it with your hand to drive it in. This constant hitting your mouthpiece may damage the mouthpipe or other part of your instrument. Simply put the mouthpiece in the mouthpipe and give it a slight twist to seat it properly.

12. Check springs, especially springs in the bottom of the valves, to see that their thrust is vertical and not sidewise. You can usually tell from the way the spring leans. Such a leaning spring exerts more pressure on the piston against one side of the casing than against the other, and tends to wear the casing out of round. If the spring leans to right, open up the coils on that side to push it back; and vice versa.

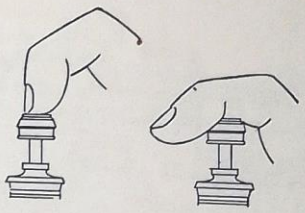

Fig. 10 — Right and wrong way to finger piston valve. If you use first joint you can make a stroke directly up and down. If you use the second joint you tend to push the piston over so it rubs against the opposite side of the casing. This in time will wear the casing out of round so it will leak.

13. Press the valves down by placing the ends of the fingers on the valve finger tips and making a vertical stroke. Some players use the second or third joint. See Fig. 10. This position pushes the piston against the opposite side of the casing, causing the piston to cock slightly and producing a bad valve action. In time this constant pushing against the opposite side will wear the casing out of round. It is no defense of this faulty style of fingering that some great artists use it. We know of one great cornet soloist who plays this way but we happen to know he has constant trouble with valve action.

14. It is the practice of some to stop valve spring "sing" by applying some vaseline. This is bad, for the vaseline is liable to get into the valves and when it does it will gum and cause trouble with the action. To remove sing, try new springs or interchanging springs from one casing to another. Also try increasing tension by stretching.

15. Don't shove heavy mutes into the bell of your cornet or trumpet with too much force. This tends to stretch the throat of the bell and may in time affect the playing qualitities of the instrument. Any mute *properly corked* will stay in the bell satisfactorily if pressed in firmly and rotated or twisted slightly. If your mutes will not stay in without jamming them in with force, recork them.

16. On the larger instruments with detachable bells, such as euphoniums, basses, and sousaphones, put a little tallow or vaseline on the bell receiver rings and bell set screws so they will work freely and so corrosion will be retarded.

17. Keep the larger instruments out of the reach of practical jokers who delight in throwing erasers, cigarette butts, clothing and refuse into the bell. This materials lodges in the bend of the bow where it cannot be seen and where it is difficult to remove. Presence of this foreign material, of course, causes stuffiness and faulty intonation.

18. In playing an outdoor concert or parade, where there may be considerable dust and grit in the air, use more oil on the valves than usual and be sure to clean your instrument thoroughly when the engagement is finished.

19. Some players have the nervous habit of sitting during tacit passages and entertaining themselves by twisting the finger tips, tightening and loosening them. Don't do it. This puts unnecessary strain on the devices which regulate the radial position of the piston in the casing, especially the star in the spring barrel type of piston and the pin in the Conn Clickless valves.

SLIDE TROMBONES

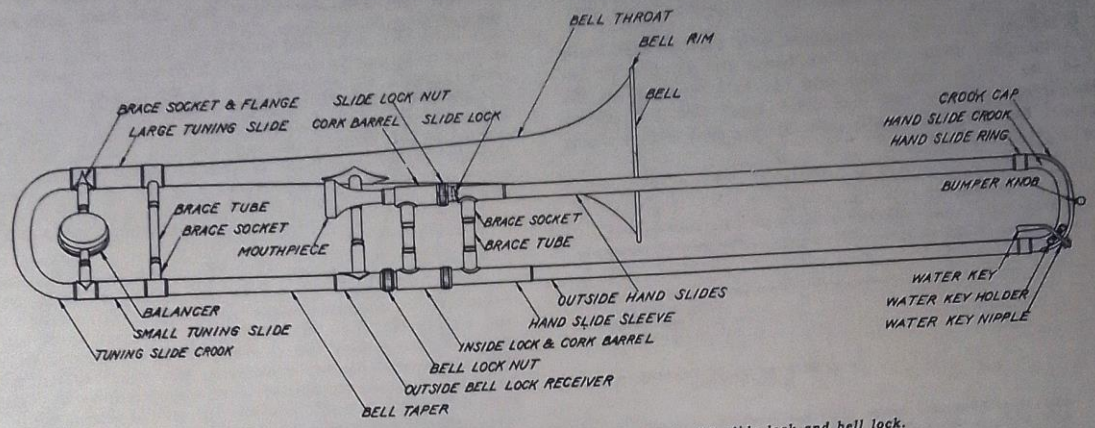

Fig. 11 — Tenor Slide Trombone, with tuning in bell. Equipped with slide lock and bell lock.

Why Hand Slides Require Careful Handling. The hand slides of the slide trombone are delicate and require careful handling. The brass outside slides have a wall thickness of from .011" (11 thousandths of an inch) to as little as .006" (6 thousandths of an inch), on the lightweight models.

Since an ordinary human hair is about .003" (3 thousandths of an inch) in diameter, the thickness of the outside slide's wall is equivalent to the combined diameters of about three fine human hairs. Consider a tube which is over four feet long made of brass which is only three hairs in thickness and sometimes is only two hairs in thickness. Further consider that this tube must fit over another tube so that the outside diameter of the inside slide is only .006" less than the inside diameter of the outside slide; that makes the clearance on each side between the stocking of the inside slide and the inside of the outside slide only .003" (three thousandths of an inch) or about *the diameter of a human hair!*

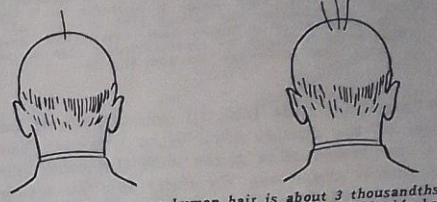

Fig. 13 — An average human hair is about 3 thousandths of an inch (.003") in diameter. Three hairs laid side by side would be about 9 thousandths of an inch across. This is the thickness of the sidewall of the average outside slide. Lightweight slides are only two hairs in thickness.

These thicknesses and clearances are emphasized because too few trombone players realize how delicately their hand slides are made. When you think of your hand slides in these terms you'll give more respect and consideration to them.

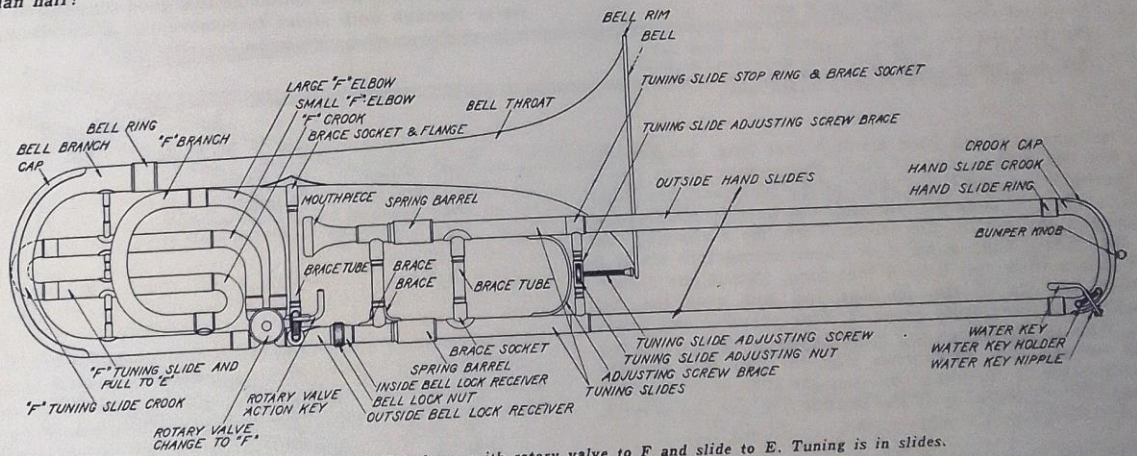

Fig. 12 — Bass Slide Trombone, with rotary valve to F and slide to E. Tuning is in slides.

Using other comparisons, an ordinary sheet of bond writing paper is about .003" thick, a cigaret paper is about .001" thick. Consider an outside slide made of brass whose wall thickness is equivalent to three thicknesses of bond paper; some slides are the thickness of only two such sheets of bond paper. Consider also that the clearance on a side between the stocking and the outside slide is equivalent to the combined thickness of three cigaret papers tightly compressed together.

Cleaning Inside of Hand Slides. When separating the hand slides from the bell on models with a slide-to-bell lock, be sure the bell lock nut is completely unscrewed and disengaged; otherwise, if the slides come loose with a jerk, the force may be sufficient to tear off the lock ring from the outside bell lock receiver. This is a shoulder which keeps the bell lock nut from slipping off the receiver. See Fig. 15. On some trombones this ring is soldered on and quite a number are torn loose in this manner. On better trombones

this lock ring is turned from the solid tubing of the bell lock receiver and is an integral part with the receiver; consequently it does not come off so easily.

After the bell lock is disengaged, hold the bell stationary and rotate the slides slightly to break the friction fit between the inside slide taper and the bell receiver; at the same time pull the bell and slide apart. Do not try to separate by using a straight pull; always pull with a slight rotating motion.

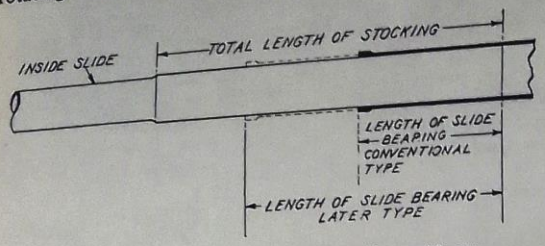

Fig. 14 — Trombone inside slide and stocking, with outside slide in solid black. The outside diameter of the stocking is only .006" less than the inside diameter of the outside slide. This makes a clearance on a side between the stocking and outside slide of only .003", or the diameter of a human hair. Dotted lines show outside slide is longer on present models than on old type trombones. See also Fig. 20.

Disengage the slide lock (if your trombone has one), take hold of the outside slide brace with one hand, take hold of the inside slide brace with the other hand, and *lift the inside slides out.* Carefully lay the inside slides flat on a clean cloth while you clean the outside slides.

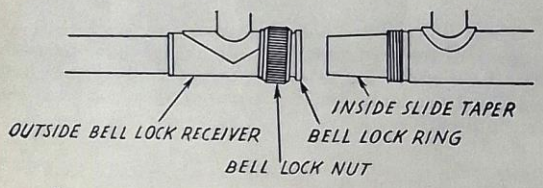

Fig. 15 — Slide-to-bell lock. In taking slides from bell, be sure bell lock nut is completely unscrewed, or bell lock ring may be torn off or damaged when friction fit of inside slide taper is broken loose.

First use a strong cord about 5 feet long, weighted at one end and with a strip of clean cheesecloth, about 6 to 8 inches wide and 5 to 6 feet long, at the other end. See illustration, Fig. 18. Run this through the outside slide crook to remove any dirt in the crook. Then use a cleaning rod for the slides. Take a piece of clean cheesecloth about 6 to 8 inches wide and 5 to 6 feet long, thread one corner through the eye of the cleaning rod and wrap the rod spirally until thoroughly covered. This prevents any metal from touching the slides and maybe gouging or marring the inside surface. See illustration, Fig. 16. This is *especially important,* for the inside of this outside slide is the bearing surface for the stocking of the inside slide and any scratch or nick will impair the slide action.

With this cleaning rod so prepared, grasp one side of the slide and clean *that side. Don't* grasp one side and clean the *opposite* side, as this tends to spring the sides. See Fig. 17. Then grasp the other slide and clean it in the same manner. Run the cleaning rod through several times, changing the cloth when it gets too grimy. Repeat until the cloth comes out clean. When pushing the rod in and out, use a slight rotating motion to prevent sticking; also be sure to hold the end of the cloth in the hand so the cloth will not bunch up and stick when pulling it out.

Finally, use the weighted cord again through the crook to clean out any dirt which may have been pushed into the crook by the cleaning rod.

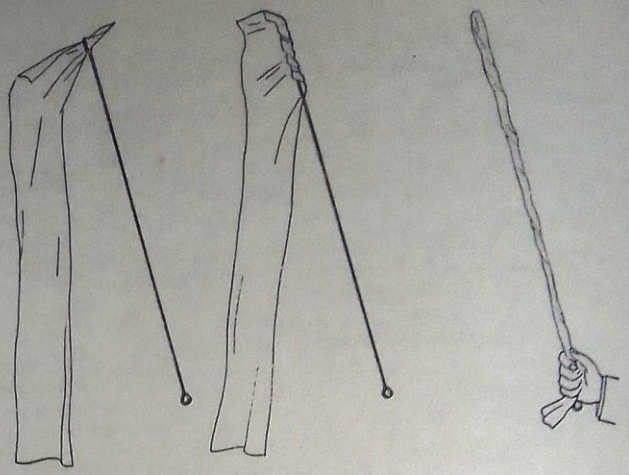

Fig. 16 — How to cover trombone cleaning rod. Use piece of cheesecloth 6 to 8 inches wide and 5 to 6 feet long. Don't simply thread the cloth through eye of rod. First insert corner in eye, then twist rod until cloth covers entire length. Hold end of cloth tightly in hand to keep cloth from sliding and bunching when you run the rod through the slide.

In cleaning the inside slides, use the weighted cord. This is recommended over the cleaning rod, as most good trombones have a delicate mouthpipe inserted inside the mouthpiece receiver, and the rod may damage this mouthpipe. See Fig. 19.

If the dirt inside the slides has become dry and hard, or if there is considerable corrosion, wash with soap and water or use some gasoline or benzene on the cloth; otherwise use a dry cloth. Be sure to use cheesecloth, as it has very little lint. A cloth with lint will leave small pieces of fuzz in the slides and these will later come out and cause trouble with the slide action. It is a good idea to run cold water through both slides to remove lint after cleaning.

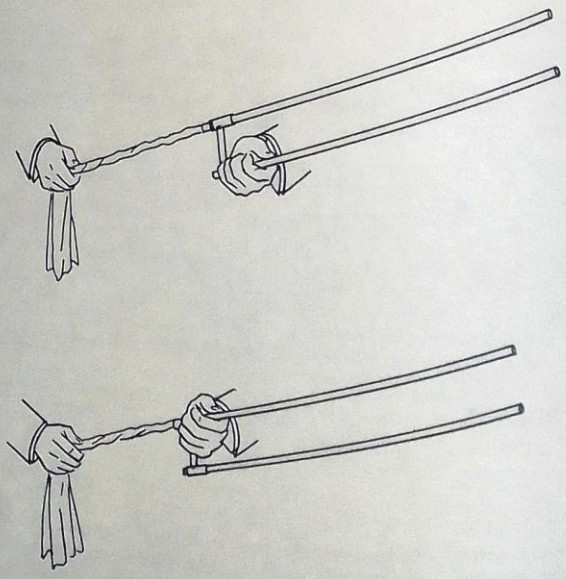

Fig. 17 — What's wrong about his picture? There are two mistakes shown. NEVER hold one slide while cleaning the other; always hold the slide you are cleaning, as in lower view. The lower view is correct except a cleaning rod is NOT recommended for the INSIDE slide. This rod may damage delicate mouthpipe. Use weighted string and cloth for inside slide. Rod is recommended for outside only.

Cleaning Outside of Inside Hand Slides. Use piece of clean cheesecloth dampened with a little gasoline or benzene. Wipe the slides until dry. Don't worry about a little stain or discoloration on the outside of the inside slides as long as the slides work well. Avoid buffing or use of abrasives to remove discoloration, as this removes the precious protective shell of nickel or chromium. Wearing through the chromium or nickel in 9 cases out of 10 has been caused by buffing or use of abrasives to remove discoloration. Actual use in playing seldom is the cause. If you happen to get a dent or crimp in the inside slide, have repairman take it out with a dent ball or bar; don't let him dress the slide down by buffing or using abrasive.

Cleaning the Cork Barrel. Dirt accumulates inside the cork barrel. Clean out this dirt with a small brush, feather, or pipe cleaner. Use gasoline or some trombone oil to loosen. If you don't keep this dirt out of the cork barrel, the outside slide will gradually draw it out and it will foul the action. Often this is the cause of a certain mysterious slide trouble. After the trombone is thoroughly cleaned and oiled, the slide action is fine for awhile. Then it begins to drag and bind. The reason is this: the dirt is being loosened and dragged out of the cork barrel. If your trombone has a spring stop instead of the cork stop, the same precautions apply. See Fig. 20 and Fig. 21.

Lubrication. *Don't work the slides when they are dry.* This causes small scratches and will harm the surface of both inside and outside slides, especially outside slides. Brand new trombones right out of the dealer's stock should not be tried until the slides are oiled. Dealers sometimes hand a customer a trombone with dry slides because they don't want to go to the trouble of cleaning off the oil after trial, but this is a bad practice. Not only does oil protect from scratches but a protective film of oil on new slides is essential to fill up the pores of the metal and guard against corrosion by body acids.

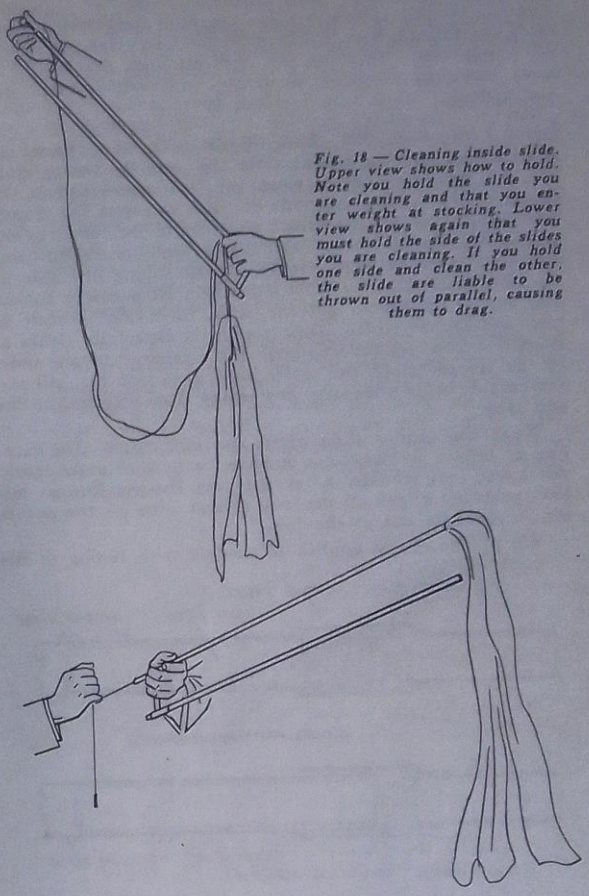

Fig. 18 — Cleaning inside slide. Upper view shows how to hold. Note you hold the slide you are cleaning and that you enter weight at stocking. Lower view shows again that you must hold the side of the slides you are cleaning. If you hold one side and clean the other, the slide are liable to be thrown out of parallel, causing them to drag.

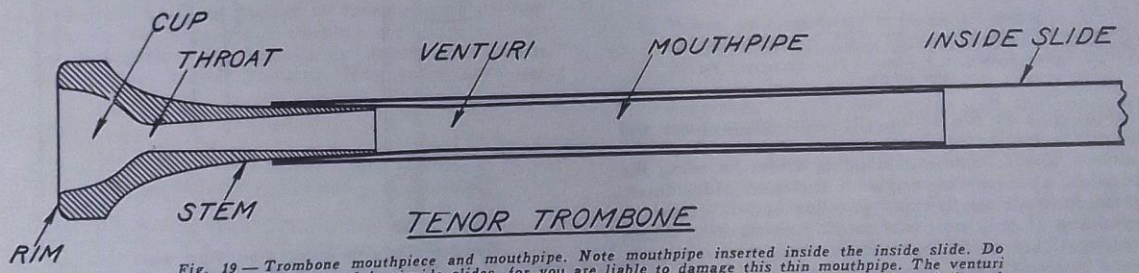

Fig. 19 — Trombone mouthpiece and mouthpipe. Note mouthpipe inserted inside the inside slide. Do NOT use cleaning rod for inside slides, for you are liable to damage this thin mouthpipe. The venturi of the mouthpipe is one of the most critical spots in the trombone and if it becomes enlarged through the use of a rod, the response of the trombone will be impaired.

There are many fads about lubricating trombones. Some players swear by Cuticura ointment, a salve for skin disease. They say it is especially good for breaking in a new trombone. Others prefer ordinary cold cream. They apply the cold cream to the dry slide, then add water.

Nothing, however, takes the place of a good trombone oil and it is recommended generally. If your slides are plated with nickel, any good trombone oil put out by a reputable manufacturer will do the job. If your trombone is plated with chromium, an emulsion oil is recommended. The specially developed emulsion oil will stick to plated slides, whereas ordinary oil runs off quickly. Although this oil was developed especially for chromium, it will work equally well on nickel.

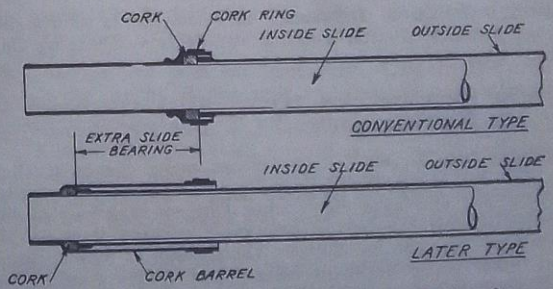

Fig. 20 — Cork ring and cork barrel construction. On later models providing for longer outside slides which run up into cork barrel, dirt collects in cork barrel. This dirt is loosened when slides are oiled and the dirt is dragged out onto the slide where it fouls the action. For outside slide length, see also Fig. 14.

Cleaning Inside of Bell. Clean the inside of the bell regularly. The handiest method is to use a weighted cord with cheesecloth on the end. Run this through the bell after each playing engagement, entering the cord through the bell. For more thorough cleaning, wash out with warm water and castile soap.

Taking Tuning Slide Out. Care should be used in removing and putting back the tuning slide. To push the tuning slide out, put your hand in between the two braces and in the center of the braces, and push the slide out with the thumb. See Fig. 22. Be sure the thumb is placed in the center of the tuning slide brace. This gives a steady, well-controlled force and distributes the pull evenly. By advancing one side of the slide more than the other side, the slide becomes cocked and stuck. Efforts to get the slide "uncocked" result in bent and kinked slides. This trouble is especially liable to happen if your model trombone has a tapered tuning slide. In the tapered slide, the inside slide goes into the bell and the outside slide goes over the inside slide attached to the bell taper.

Keep the tuning slide clean and lubricated. Use vaseline or tallow on the slides and they will work more freely and cause less trouble. After applying the vaseline or tallow, push the slides all the way in and wipe off the excess which squeezes out at the joint.

All of the above applies to models with tuning in the

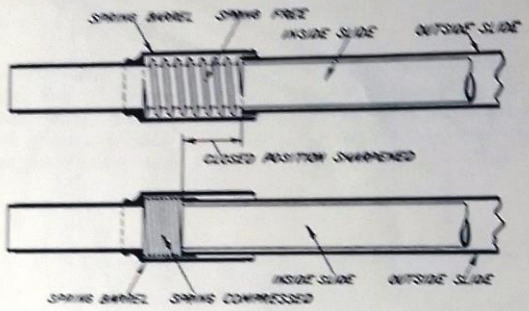

Fig. 21 — Spring Barrel. Some trombones have spring barrels instead of cork barrels. This spring enables the player to favor the closed position tones. Dirt collects in the spring barrel as it does in cork barrel and fouls the action.

bell. If tuning is in the slides, the same precautions and methods of lubrication apply. A special warning should be added, not to try to force stuck tuning slides by using the tuning device. To keep the weight of the hand slides down, this device is made as light as possible and is meant to regulate tuning of only well lubricated, free-working slides. If the tuning slides on this type of trombone become stuck, you'll save yourself some costly repairs if you'll take it to a repairman. Fortunately, this type of tuning has been replaced by tuning in the bell on most models except the bass trombone.

Cleaning Outside of Trombone. This subject is thoroughly covered under "Piston Valve Instruments — Cleaning Outside," page 7.

Cleaning Mouthpiece. See "Piston Valve Instruments — Cleaning Mouthpiece," page 6.

Analyzing Slide Trouble. There are so many causes of slide trouble that it is valuable to know how to analyze the cause quickly and eliminate the trouble. Correct diagnosis of the trouble is half the battle, just as in correct diagnosis of auto or radio trouble. Usually the trouble is minor but if you tinker and experiment blindly you'll have a major repair job before you're through.

If the slides work well when dry but begin to drag after oiling, look into the following:

1. Maybe grinding powder used by manufacturer when he ground the slides in has become loosened by the oil and is acting as an abrasive. This fine grinding powder sometimes becomes imbedded in the inside surface of the outside slides. As long as it stays in the tiny pockets in which it has become imbedded, you have no trouble with it. But when oil is applied, the particles are flushed out onto the slides and trouble starts. The only remedy is to oil and clean, oil and clean, until all the particles are removed. This may take weeks but usually it will clear up in time.
2. The other cause has been touched on under "Cleaning Cork Barrel," above. Sometimes the original grinding powder has not been well cleaned out by the manufacturer, or sometimes dirt accumulates in the cork barrel. When the instrument is dry, the dirt is not dislodged and causes no trouble. But when oil is applied to the sides, the outside slides push oil up into the cork barrel and then pull the loosened dirt out, coating the inside of the slides. This dirt spreads over the slides gradually. At first you have trouble only with sixth position, then you feel it in fifth, and so on up, until the inside of the outside slide is entirely fouled, as well as the stocking on the inside slide. The remedy is to clean out the cork barrel and keep it clean.

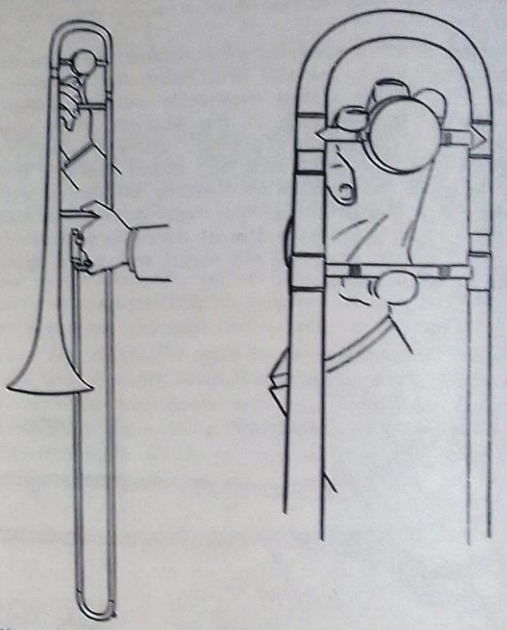

Fig. 22 — Changing tuning slide. Force applied in center of braces will avoid advancing one side of slide beyond the other and causing the slides to cock and stick. Left, opening; right, closing.

If your trombone works all right at first after cleaning and oiling but begins to drag and bind after awhile, investigate these possibilities:

1. First hold your hand slides up to the light and sight down their length. You'll probably be amazed at the dents and dinges revealed. When the slides are inspected in the ordinary way, you cannot see these dents, but when you sight down the slides they loom up. The chances are that one or more of these dents are the source of your trouble.

   Remember there is only about .003" (three thousandths of an inch) clearance on a side between the stocking of the inside slide and the inside of the outside slide. The dent may extend only .001" to .002" (one to two thousandths of an inch) on the inside of the outside slide. This may not give you any trouble when you start playing. But as the trombone *becomes warm it expands.* The dent which gave no trouble when the trombone was cool begins to drag when the trombone becomes warm and expands. If you'll lay

the trombone away until it becomes cool, it may play all right again for awhile. Then, when it becomes warm through playing, you experience the same trouble. The only remedy is to have the dents and dinges removed. A repairman can run a ball down the slide and locate the dent. This ball will be the diameter of the slide and will rub or bind when it reaches a dent.

2. More difficult to locate is another source of trouble of the same nature. Slides become slightly sprung out of parallel. Often this has been caused by dropping the hand slides on the slide crook. The drop may have been slight, and when you picked the slides up and worked them you may have concluded that no damage was done. But when you get the slides warmed through playing, the slightest springing out of parallel becomes more pronounced and the slides begin to drag and bind. The only remedy here is to send the slides to a good repairman who has the necessary precision tools to check the slides. If your repairman does not have the necessary precision tools, the trombone should be sent to the factory.

Tips on Avoiding Trouble. Some trombonists almost never have any trouble with their instrument; others have trouble constantly. The reason is that one knows how to take care of his trombone and avoid trouble while the other player doesn't. Here are a few ways to avoid trouble, in addition to the ways mentioned in the foregoing.

1. Be sure your case gives adequate protection to your instrument, especially to your hand slides. The case in which the instrument came to you from the manufacturer usually has proper blocking, but often second hand cases or "special" cases made by firms who "specialize" in cases do not give the trombone proper protection. Be particularly careful to see that the slides do not rest on nor can bump against the hand slide crook. To let this crook hit the case is fatal to good slide action, as a drop or bump of the case is liable to spring the slides.

2. The slides are generally held in the lid of the case. If so, the blocking should be loose enough so that when the lid is sprung in opening, the slides will not be sprung also. See Fig. 23 for more complete explanation of proper blocking. How often have you tried to open your case and one end has stuck. You get a good grip on the free end and yank the case open. This tortional force is what does damage to slide action. Take a stick of gum, hold one end between your left thumb and finger, the other end between your right thumb and finger. Then, holding the left end stationary, twist the right end. That's tortion and gives you a rough idea of what happens to your trombone slides when you open the case in the manner described. See Fig. 24.

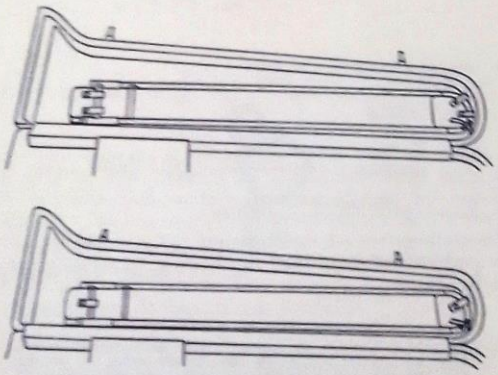

Fig. 23 — Wrong and right blocking for slides in lid of case. In top view the slides are held rigidly against the lid of the case. If the lid is sprung, the slides are wrenched and twisted. In lower view, the slides are held loosely against the lid so that though the lid is sprung or twisted, the single buttons across the brace and crook give the slides enough freedom so they are not twisted with the lid.

3. Don't hit your mouthpiece with your hand to seat it when you put it in the mouthpiece receiver. This constant hitting with the hand tends to spring the slides. Simply put the mouthpiece in the receiver and give it a slight, firm twist to seat it.

4. Between numbers many players rest their trombone on the hand slide bumper knob. In this position it is liable to skid and run under the music stand or under a chair. This results in dented slides. Keep hold of your instrument so it will not skid.

5. To avoid dropping your slides, always take hold of your trombone by the *outside hand slide brace*, even though your instrument has a slide lock. If you form this habit, you will not need to worry whether the slide lock is locked or not. The gun which "isn't loaded" is always the one which "goes off," and the slide which is "locked" is always the one which drops to the floor.

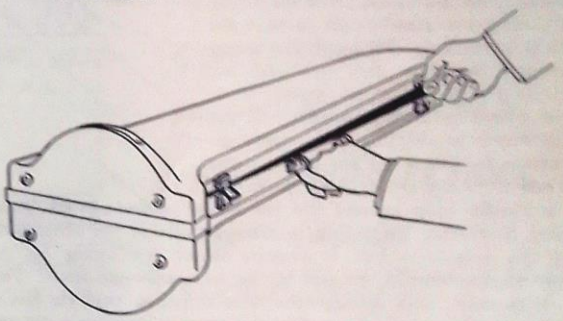

Fig. 24 — How NOT to open a slide trombone case. If you force the lid open when one end has a tendency to stick, you are liable to twist your slides.

6. When putting your trombone down, don't lay it across a chair; lay it on a flat surface, full length, or take apart and lay both sections flat. When the trombone overhangs on both sides of a chair and is supported only by the center part, the slides are put on an unnecessary strain.

7. Another careless trick of some players is to lay the trombone across the opened trombone case. Often when the player picks up his instrument he'll hit the slides against the latch and put a dent in them. They have only 2 or 3 hairs wall thickness, remember.

8. Don't go through a revolving door, holding your case by the center handle. Carry the case approximately parallel with your body and avoid getting one end of it caught in the door. If you have a formed case, carry it by hugging the bell end in the crook of your arm, close to your side.

9. Don't sit or lean on your case. This is liable to spring the lid of the case and damage your slides.

10. Examine the water key cork often and replace it as needed. Much oil from the slides soaks this cork and softens it, making it necessary to replace it often. Keep the cork in good shape so you won't get caught with a leaking water key on an important playing engagement.

For other tips read those on Piston Valve Instruments, page 7. Many of these tips apply also to slide trombone, especially those about chewing gum while playing, eating candy just before an engagament, use of heavy mutes, keeping mouthpieces and other accessories from banging around in your case loose, etc.

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1. Be sure your case gives adequate protection to your instrument, especially to your hand slides. The case in which the instrument came to you from the manufacturer usually has proper blocking, but often second hand cases or "special" cases made by firms who "specialize" in cases do not give the trombone proper protection. Be particularly careful to see that the slides do not rest on nor can bump against the hand slide crook. To let this crook hit the case is fatal to good slide action, as a drop or bump of the case is liable to spring the slides.

2. The slides are generally held in the lid of the case. If so, the blocking should be loose enough so that when the lid is sprung in opening, the slides will not be sprung also. See Fig. 23 for more complete explanation of proper blocking. How often have you tried to open your case and one end has stuck. You get a good grip on the free end and yank the case open. This tortional force is what does damage to slide action. Take a stick of gum, hold one end between your left thumb and finger, the other end between your right thumb and finger. Then, holding the left end stationary, twist the right end. That's tortion and gives you a rough idea of what happens to your trombone slides when you open the case in the manner described. See Fig. 24.

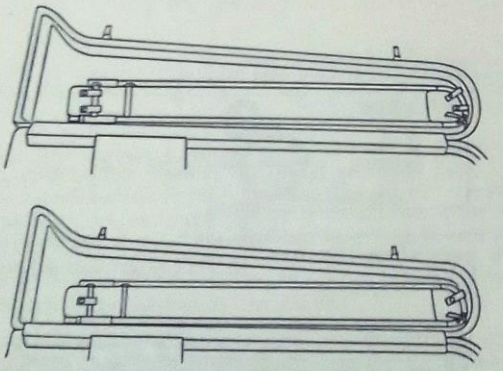

Fig. 23 — Wrong and right blocking for slides in lid of case. In top view the slides are held rigidly against the lid of the case. If the lid is sprung, the slides are wrenched and twisted. In lower view, the slides are held loosely against the lid so that though the lid is sprung or twisted, the single buttons across the brace and crook give the slides enough freedom so they are not twisted with the lid.

3. Don't hit your mouthpiece with your hand to seat it when you put it in the mouthpiece receiver. This constant hitting with the hand tends to spring the slides. Simply put the mouthpiece in the receiver and give it a slight, firm twist to seat it.

4. Between numbers many players rest their trombone on the hand slide bumper knob. In this position it is liable to skid and run under the music stand or under a chair. This results in dented slides. Keep hold of your instrument so it will not skid.

5. To avoid dropping your slides, always take hold of your trombone by the *outside hand slide brace*, even though your instrument has a slide lock. If you form this habit, you will not need to worry whether the slide lock is locked or not. The gun which "isn't loaded" is always the one which "goes off," and the slide which is "locked" is always the one which drops to the floor.

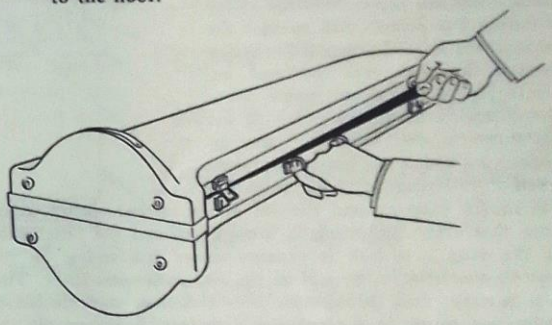

Fig. 24 — How NOT to open a slide trombone case. If you force the lid open when one end has a tendency to stick, you are liable to twist your slides.

6. When putting your trombone down, don't lay it across a chair; lay it on a flat surface, full length, or take apart and lay both sections flat. When the trombone overhangs on both sides of a chair and is supported only by the center part, the slides are put on an unnecessary strain.

7. Another careless trick of some players is to lay the trombone across the opened trombone case. Often when the player picks up his instrument he'll hit the slides against the latch and put a dent in them. They have only 2 or 3 hairs wall thickness, remember.

8. Don't go through a revolving door, holding your case by the center handle. Carry the case approximately parallel with your body and avoid getting one end of it caught in the door. If you have a formed case, carry it by hugging the bell end in the crook of your arm, close to your side.

9. Don't sit or lean on your case. This is liable to spring the lid of the case and damage your slides.

10. Examine the water key cork often and replace it as needed. Much oil from the slides soaks this cork and softens it, making it necessary to replace it often. Keep the cork in good shape so you won't get caught with a leaking water key on an important playing engagement.

For other tips read those on Piston Valve Instruments, page 7. Many of these tips apply also to slide trombone, especially those about chewing gum while playing, eating candy just before an engagament, use of heavy mutes, keeping mouthpieces and other accessories from banging around in your case loose, etc.

the trombone away until it becomes cool, it may play all right again for awhile. Then, when it becomes warm through playing, you experience the same trouble. The only remedy is to have the dents and dinges removed. A repairman can run a ball down the slide and locate the dent. This ball will be the diameter of the slide and will rub or bind when it reaches a dent.

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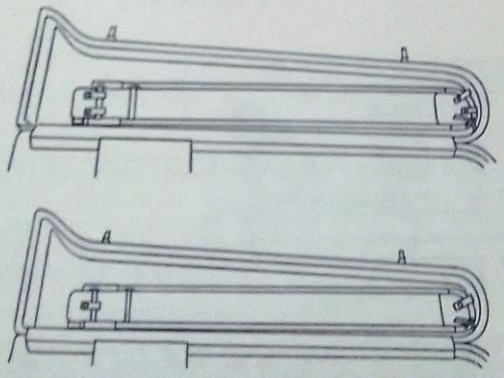

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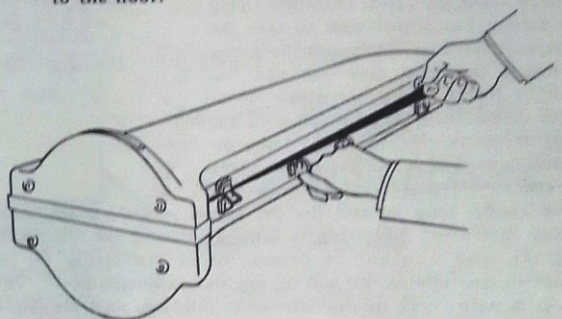

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9. Don't sit or lean on your case. This is liable to spring the lid of the case and damage your slides.

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ROTARY VALVE FRENCH HORNS

Installing New String. Most rotary valves are rotated with string. These strings wear out and have to be renewed. This is a simple operation, as shown by the accompanying diagram, Fig. 26. The first step is to loosen the string set screws. There are two of these: No. 1 on the key extension lever and No. 2 on the stop arm. Remove all old string ond cut a new piece the same length. Usually this is about 6 or 7 inches long. A good grade of linen fish line with about 27-pound test makes a suitable string.

Tie a substantial knot in the end and start the string through the hole in the key extension lever, leaving the knot on the side of the lever *away from* the valve. Give the string a strong but steady pull to seat the knot in the hole. Then pull the string around the stop arm hub and encircle No. 2 string set screw. Note the direction of encirclement of the set screw is *clockwise*, the same direction in which the set screw turns when it is tightened. Also note that the return loop around the set screw is *underneath*. Also note that after the string is brought around the other side of the stop arm hub it crosses under the string on its way to the hole in the end of the key extension lever. The rest is easy: first through the hole and then encircle No. 1 string set screw in a *clockwise* direction, bringing the return loop *under*, the same as for string set screw No. 2.

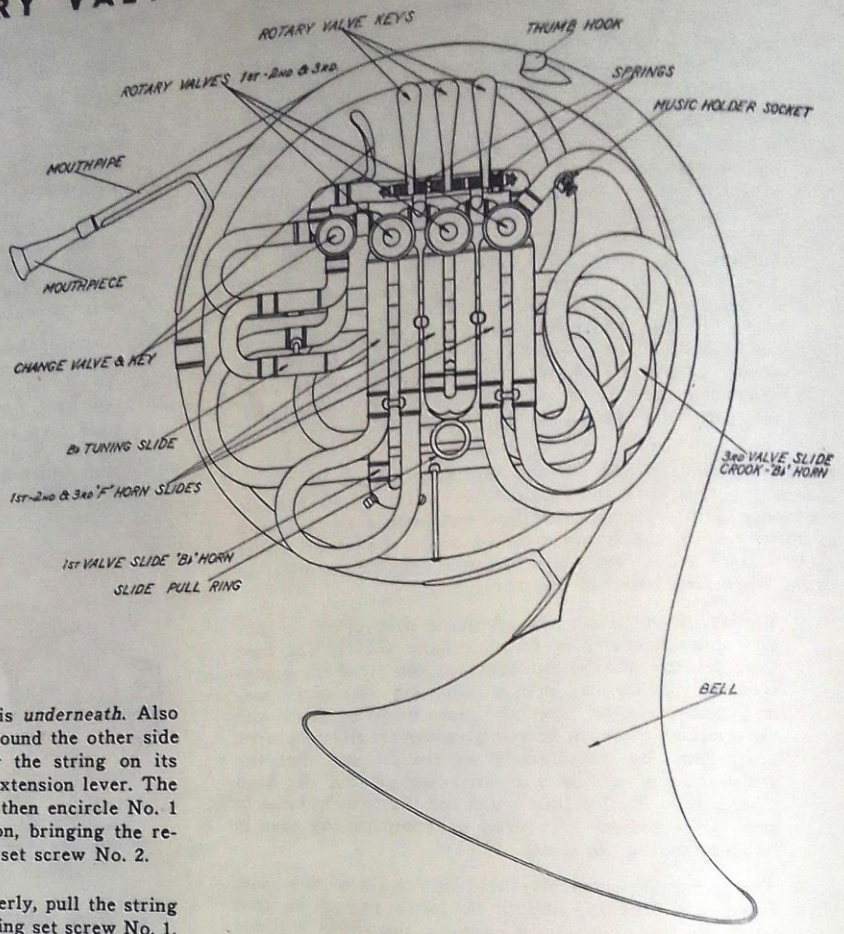

Fig. 25 — French Horn in F and B♭, with rotary valves. Parts for single French horn and horns with piston valves are similar.

Now that the string is threaded properly, pull the string so it is taut throughout; then tighten string set screw No. 1. If you work a key lever now, the string simply slides around string set screw No. 2 and the valve doesn't rotate. The next thing to do is to lower the valve key to the height to which you are accustomed and finally tighten string set screw No. 2. Usually you will find that you have pulled the string a little too taut for the rotor to turn freely; if so, loosen the string set screw No. 1 part of a turn or just enough to slacken the string a trifle. When the rotor turns freely, re-tighten the screw. Some players put a toothpick or match as a wedge between the key extension arm and the string, about a quarter of an inch below the knot. After the stringing is completed, the wedge is removed; this relieves the tension just about the right amount to allow the rotor to work freely.

Most players leave about 1¾ inches of string extending beyond string set screw No. 1 so they have a good hold on the string in case it needs retightening later. After several days the string may stretch enough to be too loose. If so, loosen No. 1 set screw, pull string taut, and retighten screw.

This diagram of stringing may not exactly suit certain valves, especially European makes. To avoid crossing the strings so they rub and saw against each other, try crossing them differently so they will work freely.

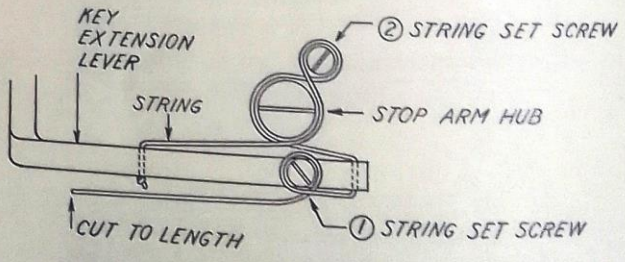

Fig. 26 — How to string a French horn rotary valve. Start at knot in string. Do not tighten string set screws (1) and (2) until completely strung and until ready to adjust height of valve keys. Further explanation in text.

Oiling the Bearings of the Rotary Valve. Valves should be oiled every two or three months. This can be done on Conn and most other types of rotary valves without disassembling the entire valve or removing the string. The steps to take are shown in Fig. 27. First loosen stop arm retaining screw about 3 or 4 turns, as at (1) in view A. Then unscrew valve cap completely. Next, with a screw driver wood handle or similar piece of wood, tap the head of the retaining screw. This will push the rotor toward the back of the valve and will force out the valve back head. You will find the retaining screw now rests against the stop arm hub. With your finger, push the rotor toward the front

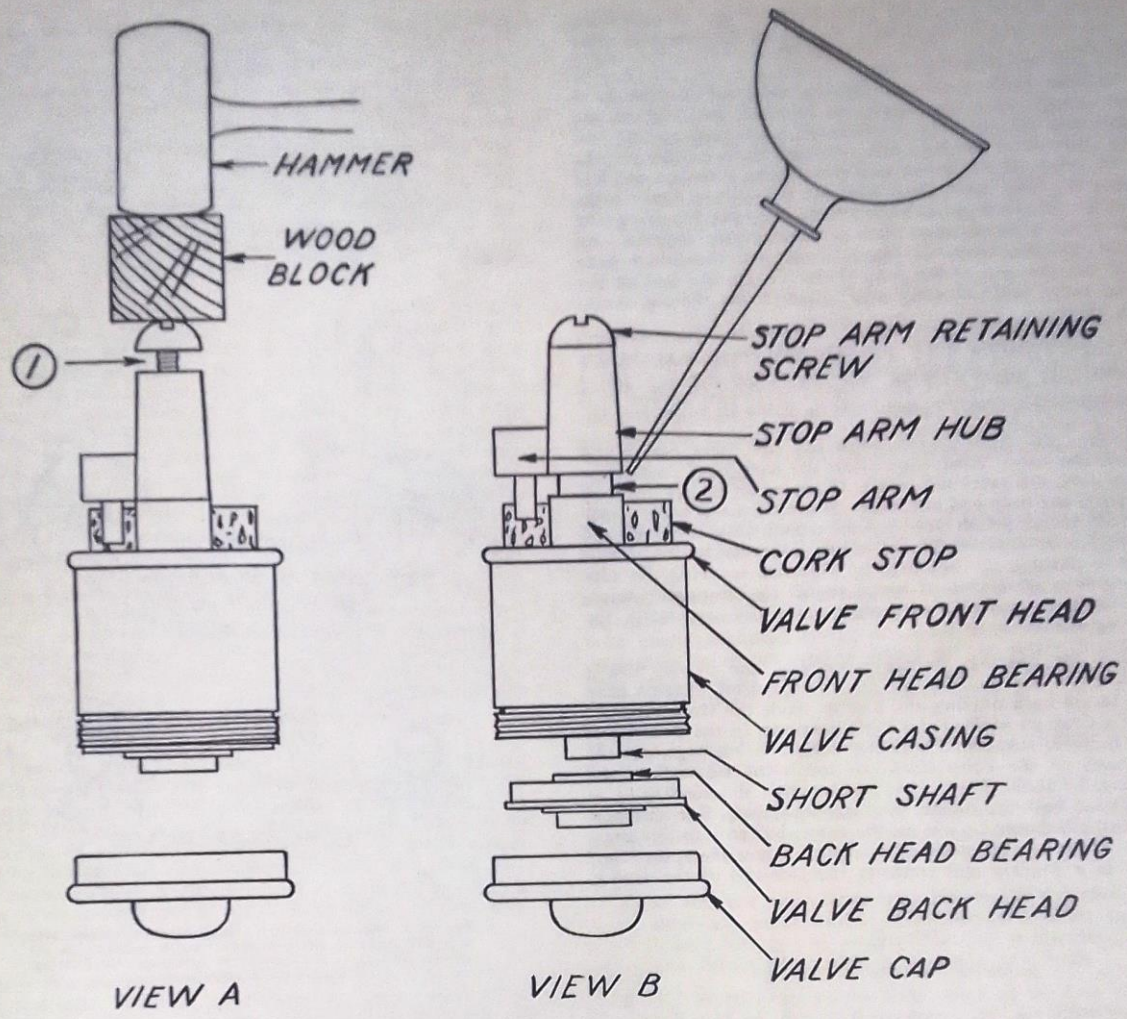

Fig. 27 — Parts of rotary valve and how to oil without disassembling. View (A) shows how to remove valve back head. View (B) shows how part of long shaft bearing is exposed for oiling at (2) and how short shaft is made accessible for oiling. Complete explanation in text.

again. This exposes a part of the rotor shaft at (2) in view B. A drop of fine machine oil should be placed here. Conn oil is recommended for this purpose. The oil will run down the shaft to the bearing in the valve front head, if the horn is held in proper position. Another drop should be placed inside the bearing of the back head and on the short shaft bearing. Don't use an excessive amount of oil, as too much oil is just about as bad as not enough.

This method of oiling applies to Conn valves, in which the rotor is suspended at two bearing points but it does *not* apply to the type of valve in which the sidewall of the rotor is in contact with the sidewall of the casing. In this type of valve, the rotor itself is a sort of bearing and requires oiling. Obviously oil applied by method outlined above will not reach the sidewall of the rotor. To oil the rotor itself, drop oil between the casing and the rotor. Do this from the back side when the rotor is pushed toward the back; this allows considerable clearance for the oil to run down.

After oiling, the back head should be replaced. As shown in Fig. 28, view A, the mark on the valve casing (1) and the mark on the edge of the back head (2) should be in line. To seat the back head, use a wood tube with a hole somewhat larger than the diameter of the shaft and bearing in the center of the back head; possibly a bamboo fishing pole section would be the easiest to secure. Place the back head firmly in proper position and with the wood tube and a small hammer or mallet, tap gently until it is securely seated. Then screw the valve cap back on and tighten the stop arm hub retaining screw. Wipe off any excess oil.

Cleaning the Valves. The valves must be disassembled for cleaning. First loosen both string set screws and remove the string, as already outlined. Then proceed as outlined for oiling. After the rotor has been loosened and the back head has been forced out, remove the stop arm retaining screw and take out the valve rotor. See Fig. 29 for picture of the valve rotor.

Remember particularly how the valve back head is removed, as described above under "Oiling the Bearings of the Rotary Valve." Many players have damaged their back head bearing by trying to pry it out by inserting a thin piece of metal between the casing and the back head, or by trying to lift the back head by catching hold of the

shoulder of the back head bearing with a pair of pliers. Do it the easy, *professional* way; don't be a dub and ruin your valves.

If the valve rotor has become corroded and stuck in the casing, try a little gasoline or penetrating oil on the back side of the valve between the back head bearing and the short shaft bearing. Also, you may have to take out the stop arm retaining screw and remove the stop arm and hub from the long rotor shaft bearing, so you can apply gasoline or penetrating oil between the long shaft bearing and the front head bearing. Then be sure to put back the stop arm retaining screw so that you can tap this screw head and not the end of the long shaft. To top the end of the long rotor shaft directly may "jimmy" the threads inside the shaft.

DON'T EVER TRY TO LOOSEN THE VALVE BY FORCING DOWN THE VALVE KEY. If the string doesn't break first, the key lever is liable to be broken off.

Once the rotor is out, wipe out the valve casing and clean the rotor. Also wipe clean the back head, valve cap, stop arm, and retaining screw. If corrosion resists ordinary wiping, use soap and hot water or a mild metal polish, such as the metal polish you use on the outside of silver and unlacquered brass or nickel silver instruments. Be careful not to damage the bearings by vigorous scouring. Be sure to remove all traces of metal polish by thoroughly washing in hot water. Dry all parts carefully, especially the casing and rotor.

Oil the bearings before assembling the valves. Use a high grade fine machine oil, such as Conn oil. Place a drop inside the back bearing and a drop inside the front bearing; also a drop on each of the shaft bearings. In the Conn horn, the rotor is suspended between these two bearings, and the sidewall of the rotor does not touch the sidewall of the casing, by about .0015" (one and one-half thousandths of an inch), or half the diameter of a human hair. For this reason no oil should be put on the rotor, but only on the bearings. However, on many other rotary valves the rotor itself acts as a bearing and contacts the sidewall of the casing,

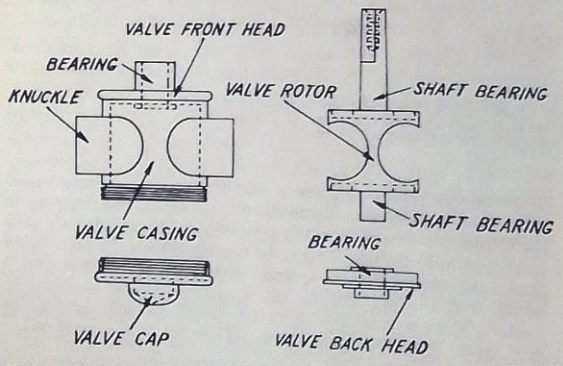

Fig. 29 — Construction of casing and rotor of rotary valve. In Conn valves, rotor is suspended at two shaft bearing points and sides of rotor do not touch sides of the casing. Oil at these two bearing points only.

and oil must be placed on the rotor to relieve friction. Be as sparing with the oil as possible, as too much oil slows up action and is almost as bad as not enough oil.

Be careful when you assemble the rotary valve. The rotors are marked No. 1, No. 2, etc., usually on the back end. The back valve head and the valve cap are also similarly numbered. Be sure you assemble all of the No. 1 parts in the No. 1 casing and all of the No. 2 parts in No. 2 casing, etc.

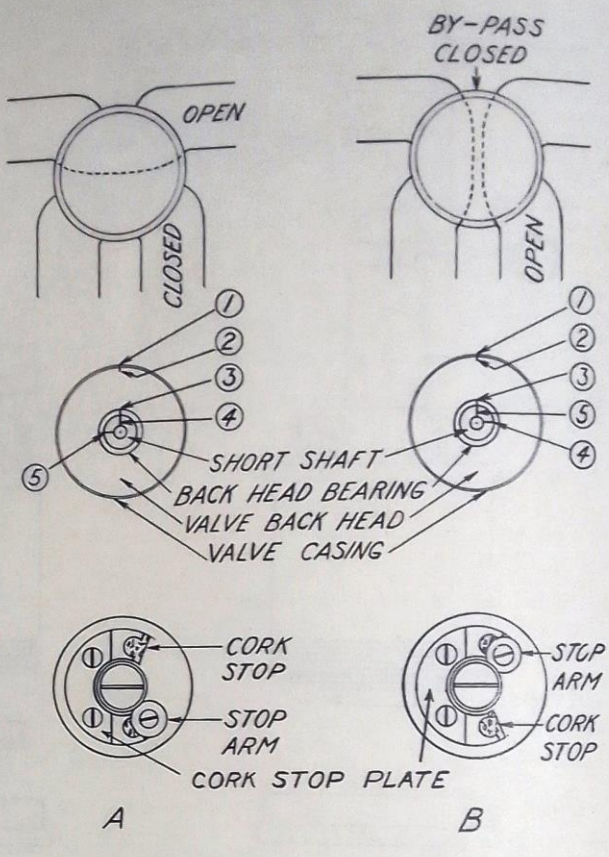

Fig. 28 — How to seat valve back heat and install stop arm and corks so ports in rotor match knuckles in the casing. This is very important in obtaining free blowing. Complete explanation in text.

After putting the rotor in the casing and seating the valve back head, turn the rotor so the air column by-passes through the valve and so the valve slides are closed. Do this before you put the stop arm on. To determine how to do this, refer to the drawings in Fig. 28. In view A, note a mark on shoulder of back head bearing, (3). Also note marks (4) and (5) on the end of the short shaft. Set the rotor so mark (4) is directly below mark (3). This puts marks (4) and (5) in the position of the hands of a clock when it is nine o'clock.

When the rotor is in this position, slide the stop arm hub over the long shaft. Note the end of this shaft is square on three sides but is round on the fourth side. This shape makes it impossible to put the hub on the shaft except in one position. This position puts the stop arm in between the two corks against which they stop IF the rotor is set properly, as described above. If the rotor is not set properly, when the stop arm hub goes over the end of the long shaft, the stop arm itself may fall *outside* the arc within the cork stops. The valve of course will not work in this position.

Once the rotor has been set as shown in view A and the stop arm hub slipped over the long shaft, the retaining screw should be screwed in and the valve cap screwed on. It remains only to install the string and adjust the height of the valve keys, as previously outlined.

Installing New Corks. When the valve key is up, the valve parts are in the position indicated in view A, Fig. 28. When the valve key is pushed down, the parts change to the positions indicated in view B. Note that the position of marks (3), (4), and (5) have changed so that (5) is now directly below (3), and the marks (4) and (5) have moved around so that they are in the position of the hands of the clock when it is a quarter past 12 o'clock. The by-pass through the valve has been closed and the air column is now directed down through the valve slides. The stop arm has moved to the upper cork. This understanding of how the valve operates is necessary before you can do an intelligent job of installing new cork bumpers.

The actual installing of the corks is simple. Press a piece of cork into the jaws of the cork stop plate. It will be held there by friction fit; on certain makes the cork must be glued in. Cut the cork larger than the adjustment requires so you can shave it away until correct adjustment is secured. After both corks are in, cut the cork back with a razor blade or sharp knife until the two conditions of Fig. 28 are met. Referring to view A, when the stop arm is pressed firmly against the lower cork, the marks on the back of the valve should be at 9 o'clock. Referring to view B, when the stop arm is pressed firmly against the upper cork, the marks on the back of the valve should be at a quarter past 12 o'clock.

It is important that the guide marks on the back of the valve are accurately set, for these marks determine where the port in the rotor meets the knuckle in the casing. If the marks are slightly off register, the ports in the rotor do not quite meet the knuckles, and the horn will blow stuffy. Shave the corks carefully so the marks register accurately; then you will have a free-blowing horn.

Bass Trombone Rotary Is Different. For some reason, the markings and settings of the rotary in the bass trombone are usually *exactly opposite* from those in the French horn rotary. In general, if you just interchange the letters A and B in Fig. 28, the diagrams will fit the bass trombone rotary. The by-pass is open and the E and F slides are closed when the marks indicate a quarter after 12 o'clock, and the by-pass is closed and the E and F slide tubing is open when the marks indicate 9 o'clock.

Care of Thin and Soft Bell. Conn French horn bells are quite thin and soft. These two qualities have been found necessary to produce the peculiar velvety tone coloring and flexible response demanded by the finest horn artists. Such bells require more than ordinary care. Although dents in the flare of the bell do not seem to affect the playing qualities of the horn, these dents look bad and are unnecessary if the instrument is given the care it deserves.

If through your carelessness or an accident your bell does become dented you had better consider a moment before you rush to a repairman and have the dents removd. The repairman has only two ways of removing the dents and that is by rubbing them out or pounding them out. In either case, a hard spot is left in the bell where the metal is worked over, for when you bend or rub or pound brass or nickel silver you make it harder. Now, since softness of the metal is an important attribute in obtaining velvety tone quality, it may be better to leave the dents in, rather than to put hard spots in the metal. Professionals in the great symphonies usually prefer to leave all but the very worst dents alone.

Don't lay the horn down on chair or table so the bell hits against a sharp edge or corner. Always lay the horn down on the mouthpipe side and so the valve keys are up. Most horns have a guard along the mouthpipe for this purpose. Don't set the horn on its bell. Many horns will balance on the bell but it is a very unstable position and the least jar or knock will cause it to fall over. Be sure your horn is properly blocked and strapped in the case so the bell does not not take the impact of any dropping or jars. Many players protect the inside of their bell from the effects of perspiration by gluing in a patch of thin patent leather. This patch is just a little more than large enough to fit the size of the hand where it comes in contact with the bell.

Cleaning Inside of Horn. This subject is covered under "Cleaning Inside Tubing," "Piston Valve Instruments," page 6, but it should be emphasized here that in the French horn it is doubly important to keep the tubing free of dirt because of the small size of the tubing. The same amount of dirt will do greater harm to the playing qualities of the French horn than it will to the playing qualities of the cornet or trumpet.

Cleaning Outside of Horn. This subject is also covered under "Cleaning Outside," "Piston Valve Instruments," page 7.

Cleaning Valve Slides. Cleaning the valve slides and keeping them clean and free-working is very important to the horn player because, having no water key, the slides are constantly being removed to empty out the water. For further information on this subject, see "Cleaning Valve Slides," "Piston Valve Instruments," page 6.

Cleaning Mouthpiece. See same subject under "Piston Valve Instruments," page 6.

Other Tips on Avoiding Trouble. In addition to the points already mentioned, here are a few tips on how to avoid trouble with your horn.

1. If you use your horn only intermittently, carefully drain all water out of the slides and other tubing before you put it away. This will make the slides and valves less liable to corrode and stick.
2. To protect the valves from sticking as a result of a period of disuse, flush them with kerosene before laying the horn away.
3. When you oil the bearings of the valves, also oil the rocker arm of the valve keys. A little oil also on the spring will help prevent it from rusting or corroding.
4. By all means carry your mouthpiece in a pouch or case. The rim is small and comparatively narrow and is easily dented. The stem also is very thin and is easily mashed.
5. Strap your horn in case securely so impact of dropping does not fall on the bell or mouthpiece. These two parts must have unusual protection.

NOTE: Also refer to "Tips on Avoiding Trouble" under "Piston Valve Instruments." See page 7. Many of them apply to French horn.

Detecting Leaks. No saxophone will play well unless the pads cover the tone hole sockets perfectly. Leaking tone hole sockets are the cause of squeaks and squawks, windy and hard blowing tones. Detecting leaks and correcting them are important duties of the saxophone player.

One way of detecting a leak is to close all tone holes and the bell and fill the instrument with smoke. A wisp of smoke indicates a leak. Leaks can also be located with a little gadget called a "feeler." This is made by cementing a narrow strip of Cellophane to a match stick. See Fig. 31. Slip this "feeler" between the pad and the socket edge and

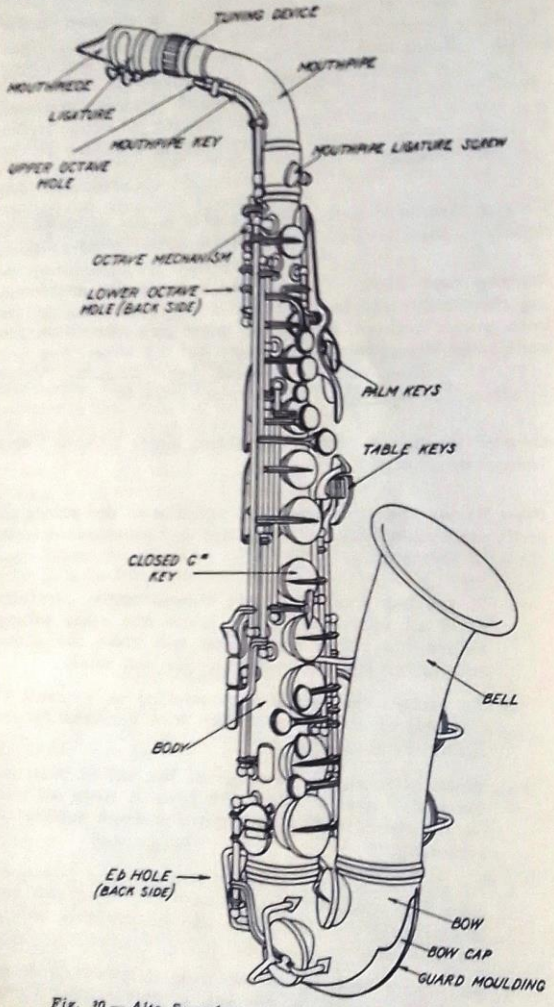

Fig. 30 — Alto Saxophone. Parts on tenor, baritone and other members of the saxophone family are similar.

close the pad with the key; then gently pull the feeler out. By repeating this process all around the edge of the socket, you will notice varying tension on the feeler. Where there is little or no tension on the feeler when it is pulled out, there is liable to be a leak.

A more elaborate equipment for locating leaks is a small light bulb on the end of an electric cord. Electricity can be furnished by installing a transformer on the regular house electric circuit or by a flashlight battery. This light is lowered into the saxophone. When the keys are closed, light showing between the pad and the socket indicates a leak.

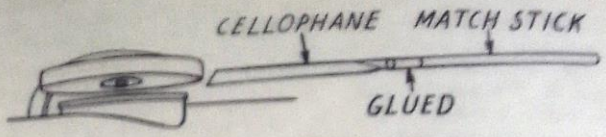

Fig. 31 — Feeler tool for detecting leaks between pad and socket. Made of small strip of Cellophane glued to match stick.

Eliminating Leaks. If the pad does not cover properly, a quick but temporary solution may be to wet the pad slightly and recrease the pad by pressing the pad against the socket. If time allows, it is a good idea to tie the key down over night. This puts a deeper crease in the pad and helps make a tight seal between the pad and top of the socket. If this does not correct the trouble, it may be that the pad is not properly seated in the pad cup. The only way to correct

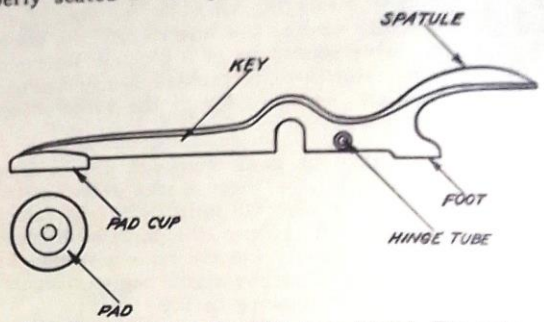

Fig. 32 — Saxophone key with parts labeled. The parts on other keys, for clarinet, oboe, flute, etc., are similar.

this is to remove the pad and reseat it. This is quite a job and requires some skill but many players can do it. Heat the back of the pad cup until the shellac is melted. This will enable you to change the position of the pad in the pad cup. While the shellac is still soft, press the pad down on the socket so the pad touches the socket edge evenly all around. While it is in this position, tie the key down until the shellac cools and solidifies.

Needless to say, heat sufficient to melt the shellac will burn ordinary lacquer off your pad cup. However, if your sax is not lacquered or is lacquered with the newer heat-drying lacquer, the heat sufficient to melt the shellac will not mar the finish. A Bunsen burner is ideal for this job, but any small flame will do the trick. Be careful not to use more heat than is necessary, or you may destroy even the heat-drying lacquer or burn the pad.

Sometimes the leak is caused by faulty key adjustment. It may be that the key has become bent so one side of the pad cup is tilted or so the front or back of the pad cup is tilted. Usually this calls for an experienced repairman but if the trouble is slight it may be possible for you to twist

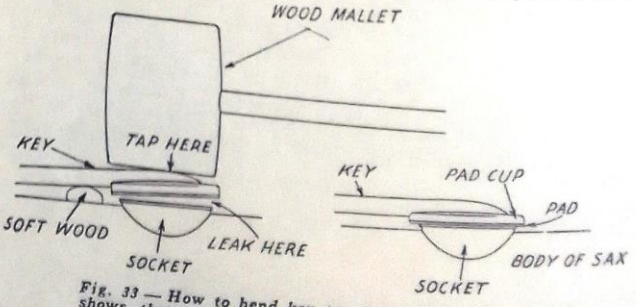

Fig. 33 — How to bend key to correct leak. View on left shows that pad cup hits socket at "heel," preventing "toe" of pad from covering other side of socket. By bending key over so pad hits socket all around evenly, leak is closed. Don't use pliers to bend key and take key to repairman if badly bent.

the pad cup with the fingers until the tilt is corrected. If the leak occurs at the outer edge of the pad cup, away from the key, a piece of soft wood can be placed under the key, back of the pad cup, and the key directly over the pad cup can be tapped sharply with a wood mallet. See Fig. 33, left. This bends the key over slightly so the pad touches the rim of the socket evenly all around. Fig. 33, right. *Don't use pliers to bend keys*, as you are liable to scratch and mar the key.

Adjusting Springs. Articulated keys, such as the closed G♯ key and the octave keys, are sprung shut by two springs acting against each other. One spring — the stronger of the two — tends to close the key. The other and weaker spring tends to open the key. When the key spatula is pressed down, the stronger spring is overcome, leaving the weaker spring to lift the pad from the socket. This spring tension must be kept very light, and unless everything is working properly the keys may not function. If the spring becomes weak, you can increase the bend in the spring and create additional tension. This is called "tucking" the spring, or putting a "tuck" in the spring. For "tucking" springs, get a metal crochet hook and file a notch in the tip. See (a) and (b) in Fig. 34. As shown in the enlarged view (c), the notch is used to push the spring, while the hook is used to pull it. This is a very handy tool which every reed instrument player should make for himself.

Lacquer on Pads. Failure of these articulated keys to open may be due to causes other than weak springs. For instance, there may be lacquer on the tone hole socket rim and on the pad. This lacquer acts as an adhesive to hold the pad to the socket. The spring is not strong enough to pull the pad away from the socket because it is stuck fast with the lacquer. In this case, use some lacquer cleaner or thinner on a cloth and carefully remove the lacquer from the rim of the socket and from the pad. Use sparingly or the thinner will cause the pad to become hard. A quick but temporary solution may be a little talcum powder or face powder dusted on the pad to counteract the stickiness of the lacquer. Another quick solution may be to use some fine sandpaper on the socket rim and on the pad to remove some of the lacquer and rough it up so it is not so sticky.

Tone Hole Sockets. Sometimes the leak is not due to the pad or key at all but to the socket. A bump on the socket may have caused it to tilt and become unlevel. In this case you are due for a trip to your repairman, for this job requires skill, experience, and special tools and equipment. He may be able to remove the dent from the body of the saxophone and bring the socket rim back to level, or he may be able to grind off the high edge of the socket so it will have a level rim.

On saxophones with a soldered-on socket, the solder is sometimes eaten through by body and saliva acids, or the solder may be broken loose by hitting the instrument against something or by dropping it. In either case the tone hole will leak. This trouble will never occur on instruments with integral sockets drawn from the body metal.

Other Troubles. The cause of other trouble in response or intonation of your instrument may be traced to the octave mechanism. If it is not in perfect adjustment or if the small octave sockets are clogged with dirt, you are bound to have trouble. You can clean the octave sockets with a feather or pipe cleaner. See location of these holes in Fig. 30. It is important these holes are kept clean. After running a swab through your instrument, check both octave holes to see that you haven't dragged a lot of dirt into these holes.

Under no circumstances attempt to adjust the height to which keys can rise above the tone hole socket rim. The manufacturer made these adjustments before the instrument left the factory and they should not be changed. Some players want greater sharpness and resonance from their instrument and accordingly have the lift of keys increased. Or they may want a flatter and softer tone, and have the height lowered. It takes an expert to do this job, and even the experts are liable to do damage to the intonation and response.

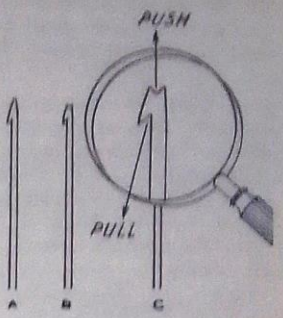

Fig. 34 — How to make spring tucking tool from crochet needle. File notch in point. Every reed instrument player should have one of these handy tools.

When you replace bumper felts for the bell keys, be sure they are of the proper length. If they are too short, the keys will be allowed to lift too high and the tones affected will tend to be sharp. If the bumpers are too long, the lift of keys will be reduced and the tones affected will tend to be stuffy and flat.

Somewhat the same effect as lowering the keys is encountered when the "biscuit" pad droops and bulges into the tone hole socket. These pads have no center rivet and when the felt and skin become wet, they lose their tautness and tend to "belly out." The result is that the pad extends below the level of the pad cup and has the effect of lowering the pad. This tends to flatten the pitch and muffle the tone quality. When your biscuit pads become droopy, replace them with new pads.

Don't "monkey" with the key mechanism. It's an intensely interesting piece of machinery but it was built to produce music and not to entertain your mechanical mind.

Cleaning Inside. Remove water, especially from the bow, before you put your saxophone in the case. This will prolong the life of the pads and the life and appearance of the lining in the case. The saxophone lies on its back in the case and water runs down the body past the E♭ hole. For this reason the E♭ pad is one of the first to go bad. Some makes of saxophones have a raised rim or watershed around this hole to prevent water from soaking the E♭ pad but this device, while it does protect the E♭ pad, routes the water around the hole and allows it to run down into the bow and collect. If the position of the case is changed, the water is liable to run out of the bow into the body and wet other pads. The only sure way to protect the pads is to remove all water from the body and bow.

Occasionally swab out the inside of body, bow and bell, and wash the mouthpipe. Don't attempt to wash the body, bow, or bell with soap and water, as obviously you will get the pads wet and ruin them. To loosen the dirt in the mouthpipe, use warm water and castile soap. Be careful to avoid getting the octave hole pad wet, and be sure the octave hole is cleaned out. Pipe cleaners or feathers are often used for this.

Keep your mouthpiece and reed clean and sanitary. A small amount of dirt in the chamber of the mouthpiece or in the grooves and corners affects its blowing qualities. The best cleaner for the mouthpiece and reed is lukewarm water and castile soap. Don't use *hot* water except for the metal mouthpiece as it is liable to warp and discolor the mouthpiece if it is made of rubber or of plastic, and it is liable to crack a "crystal" mouthpiece made of glass.

Acids and chemicals are not recommended for cleaning and for sanitary purposes. If the mouthpiece and reed are washed regularly, ordinary soap and water will keep them fresh and clean. However, to clean a mouthpiece which through neglect has become very dirty and "crusty," mix one part of muriatic acid with four parts of water and soak

the mouthpiece in this solution for ten minutes; then rinse in clean water and swab out with a cloth. DON'T put a metal mouthpiece in this solution.

Cleaning Outside. For lacquer finish, use Conn Lacquer-Life or similar lacquer cleaner and preservative. Liquid wax is also used as a preservative but be sure to rub with a soft cloth until all sticky feeling is removed. Mild soap and lukewarm water or simply a damp chamois can also be used. Avoid using hot water or special cleaners with alcohol in them, for they are liable to take the lacquer off. Avoid use of abrasives.

For plain polished brass (not lacquered), chromium, nickel silver, or nickel plated finish, a simple but satisfactory cleaner can be made by mixing a tablespoonful of fine grade whiting in a half glass of denatured alcohol. Stir the whiting well, apply lightly, and rub off carefully when dry. Be sure to use a soft piece of flannel for this purpose, as other cloth is liable to scratch.

For silver, use a high grade silver polish, in paste or liquid form, or the whiting mixture described above.

For gold, use rouge and a piece of *soft* flannel. Gold is easily scratched, so be especially careful in cleaning an instrument in gold finish. Any polish used on gold finishes should be used sparingly.

Be careful to keep all cleaning materials off the pads, as they are liable to make the pads hard. Keep cleaning materials off critical working mechanism, as they are liable to clog these moving parts. Also see that no cleaning materials are allowed to stop up the small octave holes.

Lacquer is a good preservative for all metal finishes. Clear lacquer applied over silver, gold, nickel, nickel silver, or chromium protects the plating or metal from the attacks of acids in perspiration without changing the color or appearance of the finish. "Gold" lacquer is usually applied over brass so it looks like gold. Lacquer has been improved until it ordinarily has quite a long life. This does not apply to certain individuals who "go through" lacquer in a few days. There is so much acid in their system that it eats the lacquer away quickly and even eats into the metal.

Caring for Mechanism. Oil keys where they are attached to posts, also where one key hinge moves against another. For this purpose use a fine grade of key oil, such as Conn Key Oil. Use oil sparingly, as too much collects dirt and lint. Dip a toothpick or fine wire in the oil and touch it to the part. Enough oil will run off the toothpick or wire. After working the key to distribute the oil, wipe off all excess oil. Springs will be preserved from rust if they are coated with a thin film of oil. Touch up the screws that go through the head of the posts; this will retard rust.

All saxophones have, beside the hollow hinge, the solid hinge which turns on the point of pivot screws. Since there is such a small bearing surface on the point, it is important to keep these pivot screw points lubricated to prevent excessive wear. Conn saxophones have the adjustable pivot screw which has several important advantages. See Fig. 35. If the hinge wears and the key becomes loose, the pivot screw can be screwed farther *into* the hinge to take up wear. If a post gets knocked out of line and the hinge binds, the pivot screw can be screwed farther *out* of the hinge to relieve binding. When the pivot screw has been adjusted for best key action, it can then be locked in place with the set screw so it will not vibrate nor work out of adjustment. This adjustable pivot screw is also used on Conn flutes, clarinets, and bassoons.

Keep corks greased with cork grease or tallow, especially the mouthpipe cork and those corks against which keys move, such as various articulated keys. The cork is

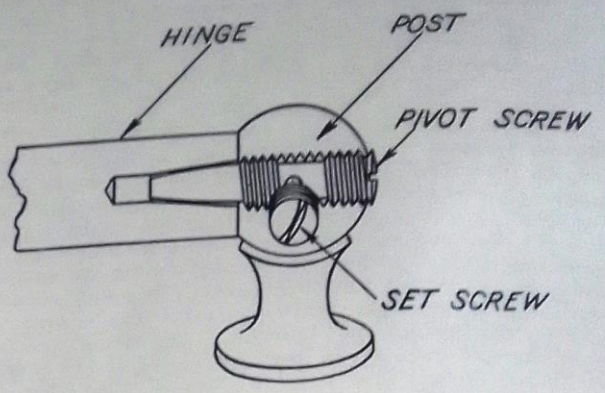

Fig. 35 — Enlarged drawing of Conn adjustable pivot screw. Note curved contour of point to conform to bearing surface. Note also set screw which locks pivot screw in place when proper adjustment has been obtained. This adjustable pivot screw saves many repair bills.

put here to deaden noise of keys hitting against each other, but they will not work freely unless the cork is greased for easy action.

Usually do not put oil or vaseline on the joint where mouthpipe and body meet, as it will work better when dry or when a little paraffin is applied. However, it is a good idea to put a little vaseline on the end plug if you are putting the saxophone in the case for any length of time. This will prevent the end plug from corroding and becoming stuck.

If the tuning device corrodes or dries out so it is difficult to work, unscrew until threads are exposed. Clean threads with gasoline or benzene, using a cloth or small, stiff brush like a tooth brush. When the threads are clean, apply a small amount of vaseline to the threads. If this simple treatment does not remedy the difficulty, don't try taking the tuning device apart. This is a job for the repairman. You may cross some of the fine threads and "jimmy" them, or you may put a kink in the sleeves that work inside each other. Such damage is serious and may require a major repair job.

Tips on Avoiding Trouble. A stitch in time save nine, and many troubles can be avoided by intelligent and careful handling of your instrument.

1. Many saxophones are designed so that part of the octave mechanism extends beyond the body of the instrument. When saxophones are made this way, the manufacturer furnishes an end plug which is inserted in the small end of the body when the mouthpipe is removed. The case is made so the top end, *with the end plug inserted*, rests in one block, while the bell and bow are held snugly by block and padding. When cradled in this position, the octave mechanism is protected at the top end, the keys do not touch the sides of the case, and the entire instrument is protected from jolts and jars. If the end plug is not used, the instrument is *too short* for the blocking and is liable to bang around loose inside the case. Such treatment results in damage to octave mechanism, key system, and tone hole sockets. Conn tenors are furnished with end plug but the altos are made so no end plug is needed. On some top octave key model altos an end plug is furnished for insertion in the large end of the mouthpipe to protect the mouthpipe key.

2. Keep all accessories in box or tied down so they will not clatter around loose inside the case. This will not only mar the finish of your instrument but may cause serious damage to the key mechanism.

3. Don't play with chewing gum in the mouth, nor right after eating candy or drinking a "soft drink." You will blow sugar water into the instrument and when this gets on the pads you will have a lot of trouble from pads sticking.

4. Protect the mouthpipe key when putting the mouthpipe on and taking it off the body. Be sure the mouthpipe ligature screw is completely unscrewed before you try to take the mouthpipe off or put it on. Also, be careful not to knock off corks when joining the arm from the octave mechanism to the mouthpipe key.

5. Don't use rubber bands to operate keys whose springs have become broken. In a short time the sulphur in the rubber band will produce a black tarnish where it contacts the instrument and will eventually eat through the finish on a plated instrument.

6. A piece of camphor in the case will absorb moisture and will retard corrosion and tarnish. Recommended in summer when humidity is high.

7. Don't make a practice of playing your instrument without a neck strap by resting the bell against a chair or table. This puts a strain on the bell and tends to cause the keys to bind.

8. Always loosen the ligature on the mouthpiece when putting it away. Constant pressure of a tight ligature is liable to warp the facing and in time may even cause a constriction in the chamber.

9. Always put the cap on your mouthpiece when it is not in use, especially when you put it in the case. This will prevent breaking many a reed and it may prevent chipping the tip or marring the facing of your mouthpiece. Even a small nick or chip on the tip will ruin a mouthpiece.

10. If you are one of those who blow lots of water into your instrument, you can make the pads last longer if you will blot them dry with ordinary blotting paper, especially those near the mouthpiece where the water is heaviest.

11. If you have a dry mouth, don't chew gum to help the flow of saliva. The sugar in the gum will cause sticky pads. Some players are helped by putting a small, smooth pebble or other non-soluble object in the mouth. This starts the flow of saliva. Be sure to take it out before playing.

12. When you put the reed on your mouthpiece, ordinarily you will put the reed on the mouthpiece and then slip the ligature over the reed. Since there is a gap between the tip of the reed and the tip of the mouthpiece, often the ligature snags the reed. You will save reeds if you will put the ligature on first (loose, of course), and then slip the reed under the ligature.

13. If the cork on the mouthpipe becomes compressed until the mouthpiece tends to drop off, there is nothing to do but recork the mouthpipe. Don't push the mouthpiece up on the mouthpipe until you throw your instrument sharp, just for the sake of keeping it from falling off. Vice versa, in order to get your instrument up to pitch, don't force the mouthpiece on if the cork is too big; you may damage your mouthpiece. On the Conn alto with the tuning device, the mouthpiece should always be pushed up flush with the shoulder on the tuning device.

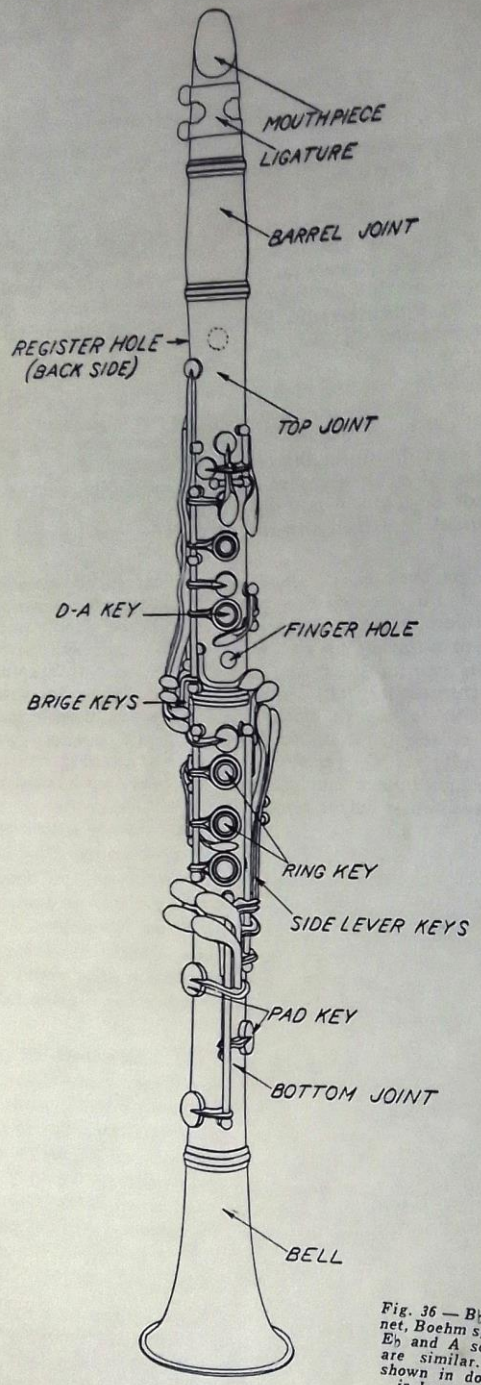

Fig. 36 — B♭ Soprano Clarinet, Boehm system. Parts on E♭ and A soprano clarinets are similar. Register hole shown in dotted line, as it is located on back side.

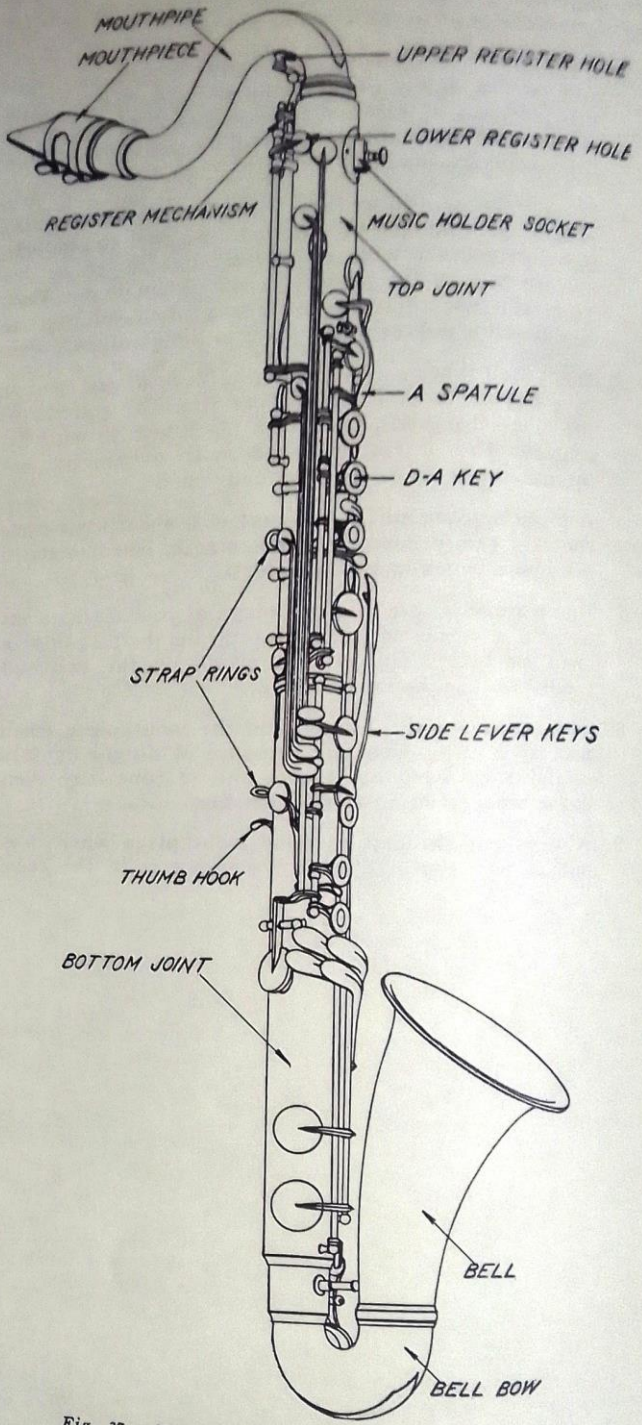

Fig. 37 — Bass Clarinet in B♭, Boehm system automatic register mechanism. Parts on E♭ alto are similar. Parts on models with double register mechanism are similar except for the register mechanism in upper part.

Metal Clarinets. Most of the points to be observed in caring for clarinets made of metal have already been covered under Saxophones, for information on cleaning and general care of saxophones applies almost equally well to metal clarinets.

Detecting and Eliminating Leaks. Also see the section on Saxophones for a detailed treatment of leaks between pad and socket (called pad seat on clarinet) and how to deal with these troubles. Additional material on keys, springs, pivot screws, and tips on avoiding trouble, contained in the section on Saxophones, will be of equal interest to the clarinet player.

Wood Clarinets. Clarinets made of grenadilla wood present their own peculiar problems, and this section will be devoted primarily to the care of wind instruments made of wood. The chief difficulty with wood is that it is liable to check and crack if not properly selected, cured, and cared for while in use. Everyone knows what happens to hands that are washed and dried constantly in cold weather; they chap and crack. The same kind of common sense rules must be observed in caring for wood instruments that must be observed in keeping your hands from chapping and cracking.

The main precautions are to keep water out of the wood and not to expose it to quick changes of temperature. Nothing can keep wood from cracking if you let water into the grain. The power of water to crack wood is illustrated by the ancient method of quarrying stone. Before dynamite was invented, holes were drilled into the stone, these holes were filled with wood pegs, and water was poured on these pegs, causing them to swell. The expansion of the wood exerted such terrific force that the stone was broken apart. The same force of nature will expand and crack your wood clarinet if you do not keep it dry.

The wood of which clarinets are made cracks because it swells and shrinks unevenly. The thickness of the wood doesn't allow it to swell evenly when impregnated with water from the inside, nor to shrink evenly when drying from the outside. The pressure of the wet wood on the inside causes the dry wood on the outside to crack open.

Protect From Moisture. Before your clarinet leaves the factory it has been thoroughly treated in oil, including usually a year submerged in oil. And yet you must continue oiling it. It will not absorb much oil, for it was thoroughly impregnated, but methodical oiling is necessary as long as you use the instrument. The new clarinet must be oiled once or twice a week for the first 3 or 4 weeks. After that, it must be oiled once a month for about 6 to 8 months. By this time it is pretty well saturated with oil and will absorb very little more. Two or 3 times a year are sufficient usually after the first 8 or 9 months.

To oil, soak a cloth with linseed or olive oil, wring out as much oil as you can, and use this as a swab. Attach this cloth to a strong cord with a weight on the other end and pull the oiled cloth through the bore 2 or 3 times. Be sure the cord is strong, for if it breaks and leaves the swab stuck in the bore of the clarinet you're in for trouble. If this should happen, make a wire hook, snag the swab and draw it out the end from which it was inserted.

Take care that the pads over closed holes are covered with little squares of paper to protect them from the oil, as oil will cause the soft skin which covers the pads to become dry and hard. A hard, dry pad will not seal the tone hole effectively. Also check the register hole to be sure your swabbing has not dragged dirt into it and partially closed it. Use a pipe cleaner or feather to clean it out. On articulated models watch also the C♯ and G♯ hole.

Daily care consists of running a swab of chamois or a piece of old silk through the bore 2 or 3 times after each playing engagement. This will remove water that has accumulated there during playing and will give it less chance to soak into the wood. Whenever you can, leave the case open so such moisture as is left may evaporate as quickly as possible. It's a good idea to keep a piece of camphor in the case during summer months when humidity is high, to help absorb moisture when the case is closed.

Be sure to take *all* joints apart. Some cases are blocked to hold the upper joint and barrel joint as a unit. If your case is so blocked, you'd do well to reblock it or get another case, as *all* joints should be taken apart. The barrel joint particularly is liable to crack, as it is nearest the mouthpiece and gets the most moisture. Taking the barrel joint off also permits the top joint to dry better, and next to the barrel joint it is the one which is most liable to become soaked with water.

Repairing Cracks. Wood is a product of nature and cannot be standardized. From the time the grenadilla wood log is cut from the wasteland of Mozambique or Madagascar, South Africa, up to the finished clarinet, fully 90% of the wood has been discarded through expert sawing, careful selection, long years of curing, treating in oil, and repeated inspection. The wood in fine clarinets is as near perfect as human skill and experience can get it. And yet a certain percentage of clarinets will crack in spite of everything, and even though they receive expert care while in use.

If your clarinet does crack, don't be unduly alarmed. Experienced professional clarinet players think nothing of it and they consider the clarinet after it is repaired to be less liable to crack again than it was before it was repaired. Many fine old clarinets are pinned in several places.

There are two satisfactory ways of repairing a crack. One is by pinning and the other is by shrinking a silver ring around the body. There are many expert repairmen who can do the job but if one of these men is not available, send your clarinet to the factory. When you send the clarinet in to the factory, *be sure to mark the crack with a pencil*, for often by the time it reaches the factory the crack has closed up so tight it cannot be found.

Protect From Dryness. Extremely dry temperature is not good for wood instruments either, and you should do what you can to protect your instrument from drying out. Hot, dry rooms in winter should be avoided. Don't leave your instrument near a radiator or hot air register. Extremely dry temperatures can be partially offset if you will carry a humidifier in your case. Your music dealer can supply this.

When your wood instrument becomes very dry, retaining rings on bell and on tenon receivers become loose and drop off, key posts become loose and twist, causing keys to bind. A quick way to tighten a retaining ring is to stretch a piece of cheesecloth over the tenon receiver or bell, push the ring over the cheesecloth, and then cut away all the cloth which shows. A quick way to tighten a loose post is to take some emery powder or some sand off a piece of fine sandpaper, unscrew the post, drop some of this powder or fine sand under the base of the post, and screw the post back in place. This will hold the post in place for some time. Of course, the best way is to drill a small hole in the base of the post and drive a pin through this hole into the wood. Conn clarinets have a post lock which avoids all this trouble with posts in dry weather. See Fig. 38.

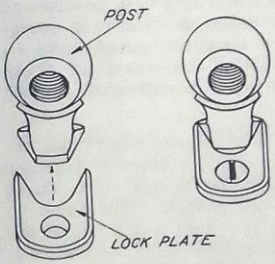

Fig. 38 — Post Lock and how it prevents post from turning in dry wood. For other methods of preventing posts from turning, see text.

Protect From Temperature Changes. Wood instruments should not be subjected to extreme changes of temperature. Don't chill quickly by taking a warm instrument into extreme cold. Don't try to warm up a cold instrument quickly by putting it on a radiator or hot air register. It is not good for a wood instrument to blow into it or on it when it is cold. Don't attempt to play a wood instrument until room temperature has gradually warmed it up until it no longer feels cold to touch.

These quick changes of temperature cause surface checks and often real cracks. These cracks may not be more than a hair line at first and may not go deeply into the wood, but in time they may develop and cause real trouble.

Keep Tenons Greased. Keep the corks on the tenons greased with cork grease or tallow and you will avoid much trouble and expense from broken tenons and damaged key action. Cork grease not only retains the resiliency of the cork and preserves it, but it makes the joints easier to put together and take apart. Nine broken tenons out of every 10 are the result of tight, "frozen" tenons. Of course, some of this tightness may have been due to expansion of the wood from

excess moisture, but many cases are due only to lack of grease on the corks. Be especially careful of the middle tenon, for it is thin and is located in between two long joints where the force of leverage is greatest. It is the one most often broken.

When tenons are not greased and do not work freely, not only are you liable to break tenons off but in your effort to force the joints together or pull them apart you may twist the keys and rods. The "death grip" you take on the joints and the twisting and pulling motions are bound to bend a key, twist a post, or spring a hinge rod. Then you will wonder why the key mechanism doesn't work perfectly!

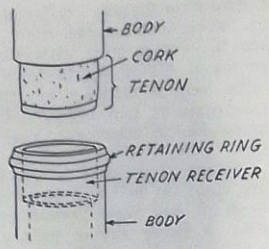

Fig. 39 — Tenon and tenon receiver. Drawing shows parts and how tenon fits down in tenon receiver.

Grease will not solve all difficulties. It may be the cork has swelled and is too large. If so, sand the cork down a little with some fine sandpaper and grease it. Don't sand down too much, or when dry weather returns the wood and cork will both shrink and the fit will be too loose. Then you'll have to have new cork put on the tenons. If the cork on a tenon comes unglued and breaks, wind string around the cork to hold it in place. If the cork is badly broken, it may be best to peel it all off and substitute string entirely until you can have a repairman recork the tenon. Grease the string as you would the cork, to make it work easily.

It is expensive to replace a tenon and in a percentage of the cases it is impossible to replace it. It is then necessary to obtain from the factory an entirely new joint — and that is doubly expensive. Why not avoid all these troubles by greasing the tenons so they will work freely?

Protect Bridge Keys. One of the first lessons taught the beginning clarinet player is how to put the clarinet together and take it apart without bending the bridge keys. These are the keys which bridge the key system from upper to lower joint. One key on the upper joint rides *above* the companion key on the lower joint. The thing to watch is that the key on the upper joint is *lifted* so when the two joints are pushed together with a rotating motion the bridge keys do *not* snag each other and become bent. Be sure the D-A key on the upper joint is depressed. See Fig. 36 for location of this key. This *raises* the bridge key on the upper joint. Then be sure you do *not* press any key on the lower joint which raises the bridge key on the lower joint. If you observe these precautions you will have no trouble snagging the two bridge keys and damaging them.

On Conn B♭ soprano clarinets with the 17-key 6-ring and the 17-key 7-ring key systems, there is a bridge key protector which prevents any of this trouble. This protector is a ramp on the lower joint which automatically lifts the upper bridge key and prevents it from snagging the lower bridge key. See Fig. 40, which explains how this works.

On the bass and alto clarinets there are two bridge keys where upper and lower joints are connected and another bridge key where the bell joins the lower branch. While these latter are bridge keys, they are usually referred to as the C key and D key respectively. See Fig. 41 on how to grasp both branches to avoid snagging the bridge keys. Note that you depress the spatule of the A key in addition to the D-A key. The depression of these two keys *lifts* both bridge keys on the upper joint. Then grasp the lower joint *below* the group of spatule keys played with the right little

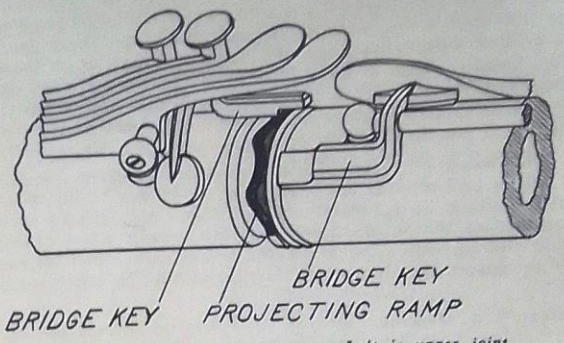

Fig. 40 — Bridge Key Protector. Left is upper joint, right is lower joint. Projecting ramp on retaining ring of lower joint lifts bridge key of upper joint so it rides above bridge key of lower bridge key on lower joint. Ramp shown as shaded area.

finger. This permits the lower bridge keys to stay down so they will not snag the upper bridge keys. Also in Fig. 42 note how heel of hand depresses D key so spatule is raised to clear C key. With these keys clearing each other, the joints can be be put together or pulled apart with a rotating motion.

Keep Clarinet Clean. Constant swabbing after each performance removes water from the bore and keeps the inside of the clarinet clean, but you must watch the register hole to see that dirt is not dragged into it by the swab. On those models with the articulated G♯, watch also the C♯ and G♯ hole. Clean out these holes with a pipe cleaner or feather. Occasionally take a look at other tone holes: they may collect enough dirt to cause some notes to blow stuffy.

To keep keys and rods clean, use some rouge on a soft but lintless cloth, and wipe them off. Be careful not to get the rouge on the pads or in the key bearings.

Be especially careful of the tone chamber of your mouthpiece, as a small accumulation of dirt there will change its blowing qualities. Keep your mouthpiece and reed clean and sanitary by washing them regularly in lukewarm water and castile soap. Avoid the use of hot water, acids, or chemicals, as they are liable to loosen the cork, or rubber inset for teeth, and may discolor or warp your mouthpiece.

Oiling Key Mechanism. Proper oiling makes the keys work more quietly and makes them wear longer. Use a fine grade of light machine oil, such as Conn key oil. Use oil sparingly, as too much oil collects dust and dirt and is worse than too little oil. A toothpick or small wire dipped in the oil will hold a tiny drop, enough for one application. Touch the tip of the toothpick or wire to the spot to be oiled. Oil bearings where key hinge joins post and where one key hinge moves against another key hinge. After oiling, work the key and wipe off any excess oil. Also apply a thin film of oil to flat and needle springs to retard rust and help give them smooth action. A bit of oil where pivot screws enter posts will retard rusting and prevent these pivot screws from becoming stuck in the post. Be sure to keep oil off the pads, as this will cause them to become hard. Hard pads are liable to leak.

Tips on Avoiding Trouble. In addition to the tips in the foregoing, here are a few more which will save you expense and worry.

1. In the register hole is a small tube which extends into the bore of the instrument. The pad seat on this tube is usually somewhat sharp and the pad will be-

come cut more readily than the other pads. Many players substitute a cork in this pad cup. The cork will not cut easily and covers just as well as a regular pad if fit properly. Nearly all oboes use cork as standard in this small register hole pad cup.

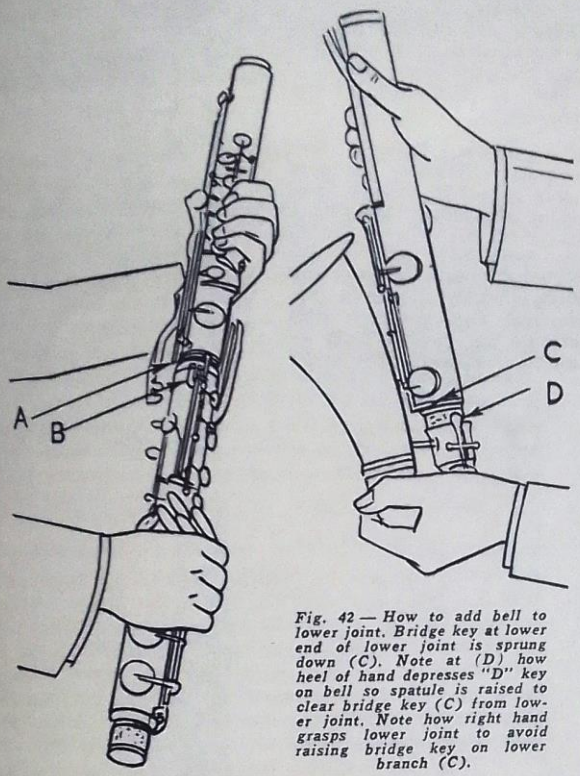

Fig. 42 — How to add bell to lower joint. Bridge key at lower end of lower joint is sprung down (C). Note at (D) how heel of hand depresses "D" key on bell so spatule is raised to clear bridge key (C) from lower joint. Note how right hand grasps lower joint to avoid raising bridge key on lower branch (C).

Fig. 41 — How to put upper and lower joints of brass clarinet together. Note, "A" spatule is depressed as well as the D-A key. Depressing these two keys raises both bridge keys on upper joint (A). To AVOID RAISING two corresponding bridge keys on lower joint (B), grasp joint BELOW group of spatule keys played with right little finger. If you grasp lower joint ABOVE these spatule keys you are liable to raise the keys (B) and snag keys (A).

2. To quiet the noise where the two parts of the side lever keys are joined, a small piece of "gold beater skin" is used. When this wears out, you can supply a new piece by taking the skin off an old pad.

3. On all model clarinets except the articulated models the ring on the upper end of the lower joint is held by a metal strap screwed securely to the body. In dry weather the wood may shrink away from this retaining ring; but you won't notice it as you will on models where the retaining ring is not held by this strap, for on the latter models you can tell when the ring is loose. On the models with the strap, the strap holds the ring solidly so it doesn't seem to be loose. However, shrinking leaves the wood of the tenon receiver without reinforcement. If you try to force the upper joint tenon into a lower joint receiver when it is in this condition, you are liable to split the wood in the tenon receiver. In dry weather examine this tenon receiver carefully and be sure the cork on the tenon fits easily into the tenon receiver.

4. Don't tinker with the mechanism. If it doesn't work properly and you can't locate the trouble by applying the foregoing simple methods, take it to an experienced repairman. If you begin adjusting a key here and changing another there, the first thing you know you will have the entire mechanism out of adjustment and in the end you'll have a major repair job.

5. Don't lay a clarinet down on its side. Stand the B♭ soprano clarinet upright on a peg. Use appropriate holder or regular instrument stand to hold alto or bass clarinet. The keys are delicate and the instrument will not stand the abuse of your laying it down on its keys. This also puts a strain on the middle tenon, which is the thinnest and most easily damaged tenon on the instrument. Further, laying a clarinet down causes the water in the instrument to run out into holes on the underside, damaging the pads. If a clarinet peg or instrument holder is not permitted in the concert band or symphony orchestra (although we can't understand why some directors ban them) and you must lay your clarinet down, lay it so the fewest tone holes are on the underside.

6. In summer the air contains more moisture than at any other season. It is then particularly that you should do everything you can to keep your instrument dry. This is the season you will have trouble with swelled tenons. Carry a piece of camphor in your case to help absorb moisture. In winter the humidity in the air decreases. Furthermore, overheated, dry rooms increase the dryness. It is during this season you will notice loose rings and posts. This dryness plus quick changes from warm to cold increases the danger of cracking. Be on your guard against quick changes of temperature and supply a little moisture by carrying a humidifier in your case.

7. When the mouthpiece is not in use, the ligature should be loosened. Constant tight pressure of the ligature may warp the facing and may even cause a constriction in the mouthpiece chamber in time. Rubber and plastics are subject to "cold flow" and constant ligature pressure may cause them to change shape. Also always put cap on to protect reed and tip of mouthpiece.

8. If you have difficulty getting your clarinet in pitch you'd better investigate the matter of barrel joints. If your instrument is very sharp with A-440 don't use too much pull on mouthpiece or barrel — get a longer barrel joint. If your instrument is flat with A-440 get a shorter joint. Conn furnishes several lengths of barrel joints to meet varying tuning conditions.

FLUTES AND PICCOLOS

Note. For wood flute or wood piccolo, see section on Clarinets. For general care of metal flute, such as cleaning, oiling, see section on Saxophones. Only those subjects unique with flutes and piccolos, and not given elsewhere, are treated here.

Cleaning Head Joint. To disassemble, unscrew tuning slide button and cap and remove. See Fig. 44. Then with metal swab or wood stick, push the tuning slide cork out. Since some flute head joints are tapered, with the upper end smaller than the lower end, it is a safe rule always to enter the swab or stick at the upper end and push the cork out the lower end. This will avoid excessive compression of the cork.

Wash head joint and tuning slide parts in warm water and castile soap. Rinse in clean water and replace. Be sure to grease the cork with grease or tallow. Usually the head joint slide is not greased or oiled. This goes for both the joint slides. If they are kept clean and are not bent or dented, they will work freely without lubrication. Some players use a little paraffin on these slides.

To reassemble the head joint, first insert the tuning slide cork through the lower end of the head joint and push with swab or stick into proper place. Usually the swab furnished with the flute has a mark ½ inch to ¾ inch from the end. Push the cork until this mark comes to the center of the embouchure hole. If you do not have a swab so marked, you can make a wood stick which will serve the purpose. Measure the exact diameter of the tuning slide nut (distance "A" in Fig. 44). Then make a mark on the stick which is exactly distance "A" from the end of the stick. In other words, distance B on the stick from end to mark should be exactly equal to the diameter of the tuning slide nut, or distance A. Use this stick so marked to push the tuning slide cork through the lower end until the mark on the stick comes to the center of the embouchure hole. Finally, screw on the tuning slide button and cap. Screw it down until the shoulder on the cap hits the end of the flute tubing.

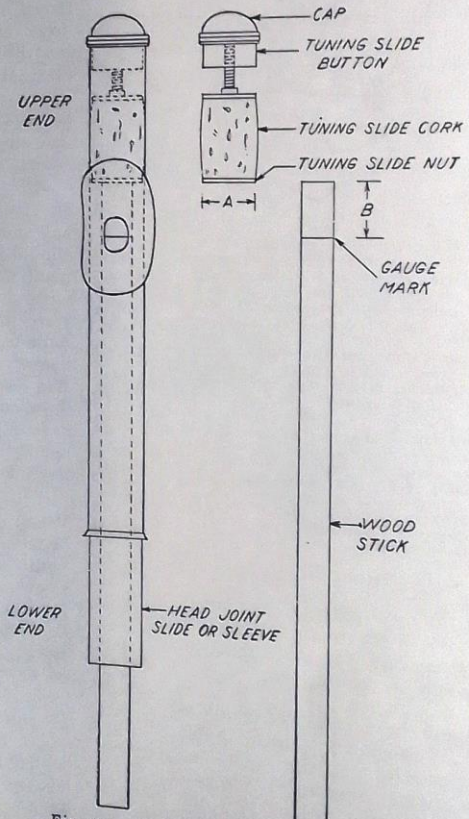

Fig. 44 — Parts of Flute Head. Text tells how to regulate tuning slide cork and how to make your own stick gauge.

The tuning button can be used to tune the flute or piccolo but it is seldom touched. Most players do more damage than good in trying to use it. Some bandmasters have the button soldered fast so it cannot be moved. The safest rule to follow is: When in doubt, don't!

Cleaning Outside. To clean body and keys, use only a clean, dry cloth. A pipe cleaner can be used to keep dust and dirt from under the keys. If your instrument becomes badly tarnished, it is best to send it to a repairman. He'll remove the keys and do a thorough job. If you attempt it, you'll not be able to do a good job and you may do more harm than good, by getting cleaning material into bearings and on pads.

Cleaning Pads. If a pad sticks because it is dirty, the best way to clean it so it will not stick is to dampen a piece of clean cloth with benzene or gasoline, place a single thickness of cloth between tone hole socket and pad, and gently but firmly hold pad down while cloth is pulled out. This usually will clean the face of the pad without causing it to become hardened.

Use Slide or Sleeve Caps. Usually two metal caps are furnished to protect the thin joint slides or sleeves, one for the lower end of the head joint and one for the lower end of the body over which the foot joint fits. These slides are very thin and in the case of sterling silver particularly they are quite soft, so don't neglect to use these caps when you put the instrument in the case.

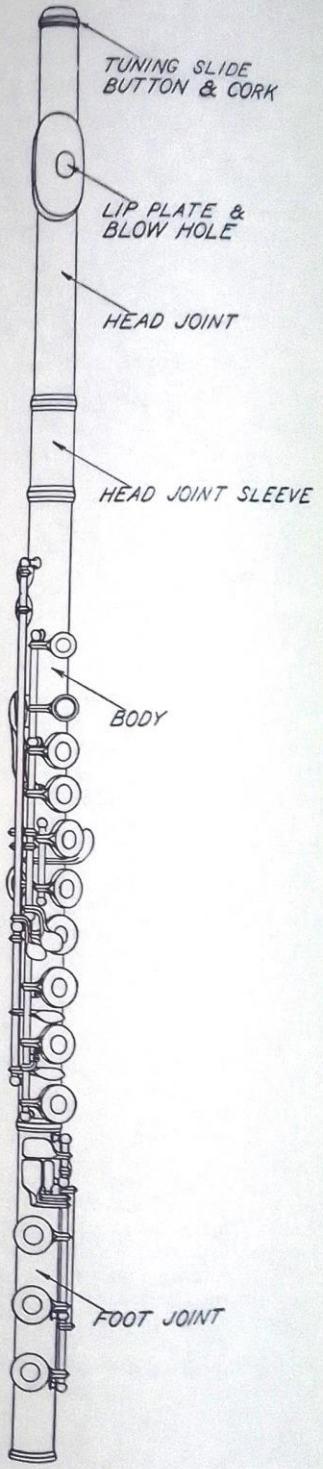

Fig. 43 — Flute. Parts on piccolo are similar only they are smaller.

OBOES

Note. For care of oboe, see also section on Clarinets. Most of the material on care of wood, tenons, bridge keys, etc., applies equally or more so to oboe. For additional material on how to detect and eliminate leaks between pad and pad seat, on spring and key adjustments, and on tips to avoid trouble, see sections on Saxophones and on Clarinets. Only those subjects unique with oboes, and not given elsewhere, are treated here.

Small Bore. The bore of the oboe is considerably smaller than that of the clarinet, especially in the upper joint. It is also conical in shape instead of cylindrical. Because of this small conical bore, the suggestions on care of wood in the clarinet section apply doubly to oboe. The upper joint is more liable to crack because it is so small on the inside and therefore difficult to keep dry. If your oboe does not have a small swab which will go through the upper joint, be sure to obtain one or use a feather or cloth swab on a weighted cord. If you use a draw cord swab, be careful you do not get the swab stuck in the tapered bore. It is *absolutely essential that you swab out this upper joint carefully after every practice period or playing engagement,* and that you oil the inside bore methodically, especially when the oboe is new.

Many Articulated Keys. The key system of the oboe is probably the most delicate and intricate on any key instrument. There are a great number of articulated keys and trill keys which require the most exact adjustment and the most extreme care in handling. Keep tenons fitted and greased so they work freely, for any rough handling in putting the joints together and pulling them apart is sure to cause serious damage to this delicate key system. It is a safe rule to take your instrument to an experienced repairman for all but the most minor key adjustments.

Bridge Keys. Snagged and bent bridge keys are one of the most common troubles of the oboist. All of it is due either to ignorance or carelessness. There are 3 bridge keys on the oboe, two from upper to lower joints and one from lower joint to bell. See Fig. 45. Because there is considerable variation in construction among different makes of oboes, it is difficult to generalize too widely on how these bridge keys work. Most of them work as follows.

To connect the upper and lower joints, depress the bridge key connecting rod on the upper joint so the lower end of this key is *lifted.* The bridge key on the lower joint is sprung down. So far, so good — the bridge key on the upper joint will ride above the bridge key on the lower joint when the two joints are pushed together or pulled apart with a slight rotary motion. You must be careful, though, where you take hold of the lower joint, for if you grasp it near the upper end you are liable to raise the lower bridge key so it will snag the upper bridge key.

Also, the other bridge key between the upper and lower joints is connected with the F♯ ring at top of lower branch and is constructed so the connecting arm is held *up* by a spring. So long as you don't depress the F♯ ring, this bridge key will stay up and will not snag the pad cup with which it connects on the upper branch. Therefore, the best place to grasp the lower joint is at the lower end of the joint.

The B♭ key on the bell is connected with the key system at the lower end of the lower joint. This B♭ key is sprung open and the arm from it is sprung down. The connecting arm from the lower joint is also sprung down. It is obvious that the arm from the B♭ key must be raised to avoid snagging the connecting arm from the lower joint. This is done by depressing the B♭ key. This lifts the B♭ key arm so it rides *above* the connecting arm from the lower joint. With these bridge keys in this position the bell can be put on lower joint without snagging the bridge keys.

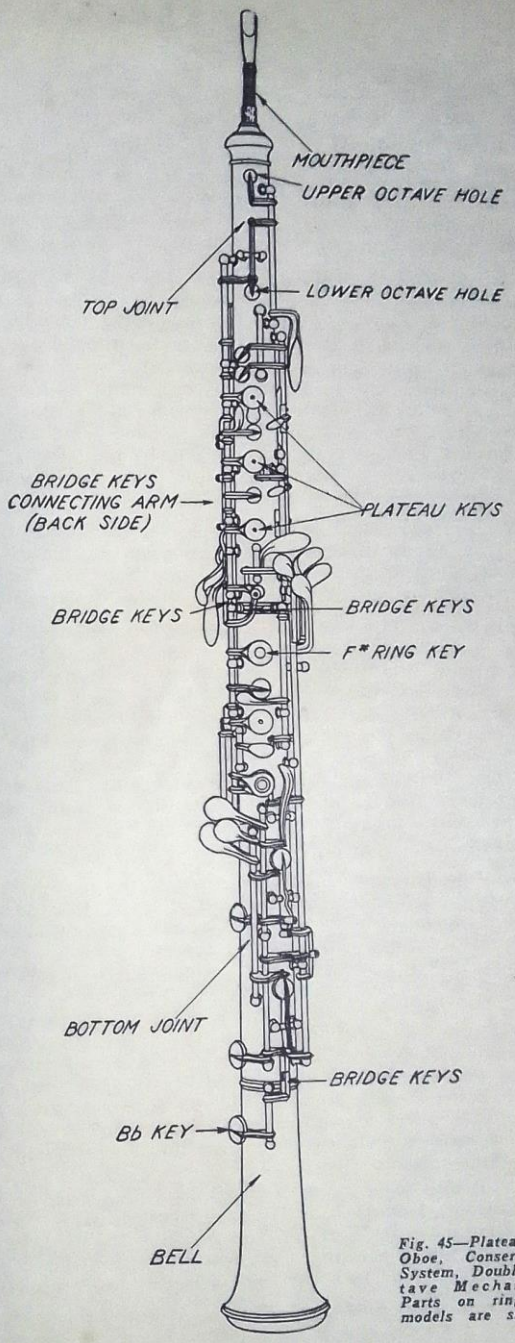

Fig. 45—Plateau Key Oboe, Conservatory System, Double Octave Mechanism. Parts on ring key models are similar.

Use Tenon Protectors. Usually two wood tenon protectors are furnished with an oboe. These go on the lower ends of both upper and lower joints when the instrument is put in its case. The tenons on the oboe are rather thin and frail and should be protected with these wood caps. Also, the case is blocked for these two joints with caps attached and if you put the joints in the case without the caps, the joints will be loose in the case and the keys are liable to become damaged.

BASSOONS

Putting It Together. The bassoon consists of 6 parts, namely: The reed, or mouthpiece; the metal crook, also called the mouthpipe, or bocal; the tenor, or wing joint; the butt, or boot joint; the bass joint; and the bell. For identification of all parts, see Fig. 46.

Before you start to assemble the parts, be sure all tenons or joint ends are well greased with cork grease or mutton tallow. Unless tenons fit well into tenon receivers and unless they are well greased, you are liable to break a tenon. To repair or replace a tenon is very expensive, so give them the best of care.

To assemble, first place the tenor joint and the bass joint side by side in the exact position as used when the bassoon is ready to be played upon. In most cases these two joints are blocked in the case so they they lie nested together in playing position. Hold these two joints firmly together in the left hand. Next, take the butt joint in the right hand and insert the two joints held in the left hand into the butt joint. Start them carefully and easily, pushing each joint into its proper position. Be careful not to snag the bridge key between tenor joint and butt joint. Then, place the bell in position on the bass joint, being careful not to snag the bridge key. Finally, place the crook in its position in the tenor joint, pushing it down all the way so that the small pad in the "whisper key" at the top of the tenor joint covers the tiny hole in the crook.

To take apart, first remove the crook, next the bell, then the bass joint, and finally the tenor joint. When putting the parts back in the case, usually you will nest the bass joint and the tenor joint together in their playing position and put the two in the case together.

Care of Crook. Never carry the bassoon with the crook inserted in the tenor joint. Only the greenest amateurs will be found running around with the crook in the tenor joint. With the possible exception of the reed, the crook is the most delicate part of the bassoon, and it should be handled with great care so it will not become bent or damaged in any way. Clean it often by running warm water through it. A satisfactory swab can be improvised by using 3 pipe cleaners and joining them end to end by twisting ½ inch of ends together. This will be the right length to go through the crook. Keep the tiny hole open by inserting a broom straw or by blowing through it. Never use metal pin of any kind, as you are liable to mar or enlarge the hole.

Protect From Moisture. During practice, water may gather in some of the tone holes. This can be removed by blowing into the hole where the water is causing trouble. If water should accumulate under any of the pads, raise the key and blow out the water; then remove the water from the pad seat and pad by inserting a piece of thin blotting paper between the two and pressing lightly on the key.

Avoid laying the bassoon down on its side after a practice period or playing engagement. If you do, water will run into the holes on the underside and cause trouble. In time the pads will become hard from excess wetting, and hard pads are liable to leak. When resting for short intervals, stand the bassoon on end and be sure to put it in a corner or other place where it is not liable to be knocked over. By standing the bassoon on end, the water will drain into the butt joint and then can easily be removed.

To remove water from the butt joint, first remove the crook and reed so these delicate parts will not become damaged. Next, remove the bass joint and bell. Then, tip the bassoon so the water will run out the hole from which the bass joint was removed. After the water is removed, replace the bass joint and bell, and finally the crook and reed.

Protect From Quick Temperature Changes. Never subject a bassoon to extreme or quick changes of temperature. Particular care should be taken NEVER to warm up the instrument *quickly* after it has been exposed to cold long enough to become chilled through, and it should not be blown into until it is warm enough not to feel cold to the touch.

Cleaning and Oiling. Keep your instrument clean at all times. Dust under the keys can be removed with a small, soft brush. Keys and other metal parts can be cleaned with a soft cloth or chamois. Always clean the instrument outside and inside after using. Special swabs are furnished for cleaning the bore. Bearings and moving parts of the key mechanism should be oiled at frequent intervals but avoid applying too much oil at one time. Dip a toothpick or fine wire into the oil and apply only what adheres. Work the key or part and wipe off excess oil. Use only a high grade fine machine oil, such as Conn key oil.

Other Suggestions. For other suggestions on care of keyed instruments, see sections on Clarinet and on Saxophone.

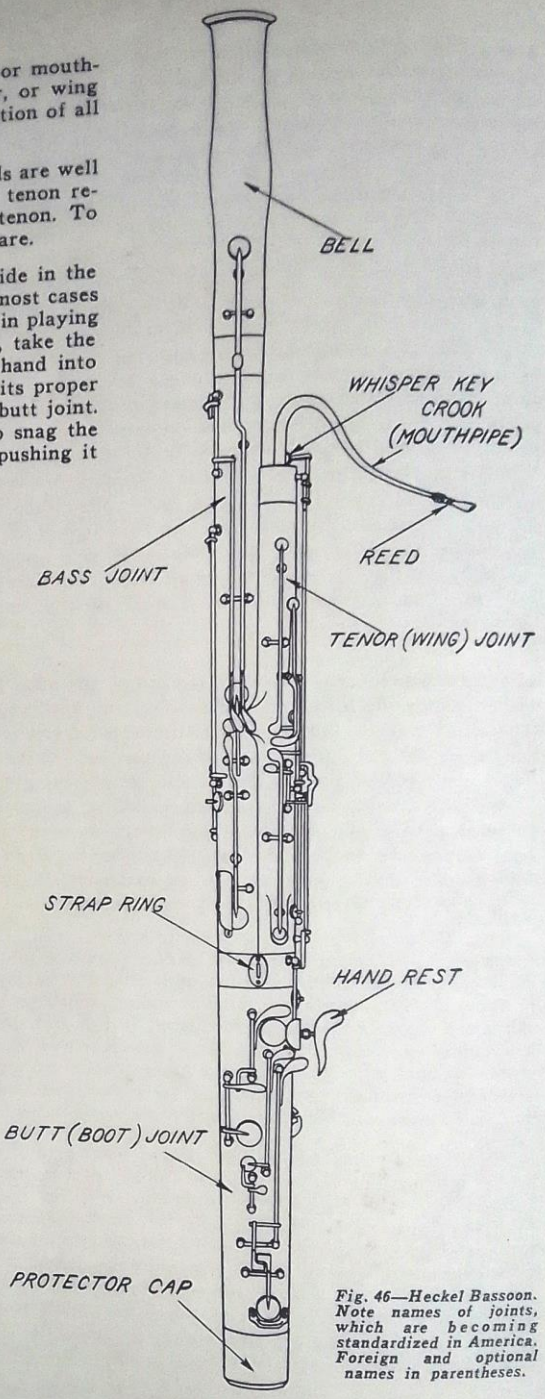

Fig. 46—Heckel Bassoon. Note names of joints, which are becoming standardized in America. Foreign and optional names in parentheses.

CAUTION. Do *not* follow for the bassoon the suggestions about oiling the wood clarinet. Bassoons are made of maple mostly, instead of grenadilla wood, and the inside of the bore is usually shellaced or otherwise treated to resist moisture. Conn bassoons should never be oiled, for they are specially treated on the inside of the bore. All that should be used on the inside of the bore is a dry cloth or chamois to remove water and dirt.

There may be some bassoons that should be oiled; if so, the manufacturer will probably so state. If your instrument has a strong tendency to become water soaked, probably it should be oiled. But regardless of whether your bassoon should or should not be oiled, DO NOT oil the tenor joint or small side of the butt joint if these parts are rubber lined. Oil will cause the rubber to deteriorate.

PERCUSSION EQUIPMENT

General. Most of the neglect in caring for percussion equipment is the lack of attention to the heads and snares. This will be treated separately; however, there are a few other general suggestions which should be helpful in getting the longest possible service from your percussion equipment.

All hardware should be kept dry, and in case the equipment gets wet in an outdoor appearance or for any other reason, it should be carefully dried and wiped with a cloth with a little machine oil on it to prevent rusting. The bolts, screws, strainers and other moving parts should be kept in good working order by oiling very lightly occasionally

It is well to cover the instruments with cloths between rehearsals if they are not put away in cases, shelves or some other place that is dry. It is especially important that marimbas, xylophones, vibes and bell lyras be covered so that visitors to the band room will not be tempted to damage the surface of the bars by scratching them. It is likewise very important that the tympani be covered, using fiber discs for the heads and the regular mackintosh covers for the instruments.

Snares. Wire wound silk snares and the so-called "snappi snares" require very little attention, except that they have a tendency to cut through the snare head at the edge. The easiest precautionary measure is to put a strip of adhesive tape or preferably gummed paper about ½" wide on the head at the point of contact. This will prevent wear, and in most cases will prevent the head from tearing around the edge.

If the drums are equipped with gut snares, the snares should be kept taut when the drum is not in use to prevent the snares from stretching unevenly or becoming entangled. Gut snares are affected by the moisture in the air, and for this reason must have much more careful attention than snares of other types.

One of the most satisfactory types of snares in use is the hard woven snares, as these will not damage the head nor are they affected by the humidity. This type of snares is recommended for parade drums, and, in most cases, concert drums used by the average band. If the drummers or bandmaster happen to be thoroughly familiar with the proper care of gut snares, and if proper attention can and will be given daily to the snares, gut snares do give a certain quality of tone that cannot be duplicated with any other snares.

Drum Heads. In tensioning the snare drums, start on the batter side, applying tension to one screw and going clockwise around the drum, not across to the opposite rod as some think necessary. Do not turn screw very much at a time and give each screw the same amount of tension, keeping the hoop as even as possible. Test the tension of the head with the forefinger as tightening proceeds. There is no set rule for correct tension. When the batter head is up to playing tension it should give just a little to pressure of the forefinger on the center of the head.

Follow the same procedure in tensioning the snare head, but do not apply as much tension as in the case of the batter head. This is possible on separate tension models only. Test the head tension with the forefinger near the center of the head next to the snares. The head should give freely to this pressure, a little more so than in the case of the batter head.

The tonal crispness of the drum determines the correct tension. Do not tighten the heads until the tone is "glassy" hard nor allow it to be too loose with a resultant "soggy" tone. A little experimenting will help to solve the problem.

More drums are spoiled from loosening the heads too much than from leaving the tension normal. A good rule to follow is to leave the heads alone as much as possible after tensioning. When the weather is damp and rainy it is necessary to add tension to maintain a good tone. When through playing, the drummer must release this extra tension to allow the heads to return to their normal condition, so that when the atmosphere dries, and the heads contract, breakage will not result.

When the drums are not to be used for a few days, loosen the heads a trifle (about one complete revolution of each screw) but not to the point of complete looseness.

Cheap drum heads are a waste of money. Use only the best obtainable.

Tympani. Tympani heads are subject to atmospheric conditions and during cold, dry weather, or when kept in a steam heated room, the heads shrink to such an extent that there is not enough slack to produce low tones. When this occurs, a restretching process is necessary. This is done by removing the counter hoop and moistening the head well on both sides. Repeat this moistening operation two or three times at five minute intervals. The head under this treatment will become very soft. Replace the head on the kettle, and apply tension by means of the hand screws, drawing the counter hoop down about one-half inch evenly all the way around, then cover the entire head with paper, or a cloth, to retard drying. Allow to dry thoroughly (24 to 48 hours). This process restores the proper slack for obtaining low tones.

When the tympani are not in use, do NOT release all tension from the heads. Leave them tuned to A (large drum) and D (small drum) for best results. If the heads become dry and make a cracking noise during tuning, due to friction over the edge of the kettle, first clean the edge of the kettle; then use a dry lubricant, preferably flaked graphite (talcum powder will serve), rubbing it into the edge of the head and the top of the kettle.

Paraffin or wax may also be used but either tends to gum in a few months, requiring cleaning and a fresh application. Do not use any kind of grease, oil, or vaseline or any so-called head restorative on tympani heads.

Tympani heads are specially processed for use on tympani and are clear and transparent. The use of fresh, live heads is strongly recommended. When the heads become old and dry they should be changed. Hard, dry heads will not produce good tone or proper resonance.

Keep your tympani in good mechanical and playing condition at all times.

Cymbals. Mount the cymbals on straps (with pads, preferably) which will allow them to vibrate freely and reduce possibility of breakage.

Strike the cymbals with a full glancing blow, never in a straight "in and out" motion. This latter method chokes the tone and increases the danger of breakage.

Note. For suggestions on storage and handling of percussion instruments, see section on Storing, Handling, and Repairing instruments.

CARE AND PRESERVATION OF REEDS

Storing. Cane from which reeds are made is a water plant and does not like hot, dry weather. Do not store reeds in a dry, overheated room. This takes the life out of the reeds and is liable to cause them to crack and split. Carry your reeds in a tightly fitted case. Better still, wrap them in oiled silk. If you carry on your person more reeds than will fit into your case, carry them in an outside pocket, not an inside pocket, as the heat from your body has a drying effect which is harmful.

Caring for Reeds After Playing. Clarinet and saxophone reeds should be flattened against a piece of glass, plastic, or non-rusting metal while they dry after being played. This will keep the tip from drying with wrinkles or waves in it. To remove excess saliva from reed, squeegee it by pressing it with the fingers against the facing of the mouthpiece or against a piece of glass. Wash the reed occasionally in lukewarm water and soap. This removes bacteria which may cause mold. Mold or mildew will ruin the reed.

Keeping the Reed Moist While Playing. Keep your reed moist during long periods of rest in a playing engagement. Most players hold the reed in the mouth but some use moist cotton. The oboe and bassoon players must give special attention to their reed as it is liable to dry out and close up. These reeds are gouged very thin and dry out quickly.

STORING AND REPAIRING SCHOOL INSTRUMENTS

Storage Compartments. To protect instruments from theft and damage, it is recommended that each instrument have its own storage compartment. Large instruments should have large compartments near the floor, the small instruments should have smaller compartments above them. Each compartment should have a door covered with about half-inch wire mesh and it should be locked with a good lock. The wire mesh allows ventilation, especially desired for woodwinds. The lock protects each instrument from theft and places responsibility on the student to whom it is assigned. The student is given the key to an instrument compartment and this instrument is his responsibility. If he keeps it locked when not in use, it will not be stolen. Instruments left in open shelves to which any and all members of the band or orchestra have access are the responsibility of no one student. Instruments in open shelves mysteriously disappear sometimes, and it is difficult to place guilt.

Location of Storage. Considerations to keep in mind in locating storage for instruments are convenience to rehearsal rooms, band or orchestra rooms and auditorium, excessive dampness, excessive dryness. Try to locate storage compartments for large and heavy instruments, such as tympani, bass drums, bass horns, bass viols, harps, near the place where they will be used in the band or orchestra. Don't, for instance, place the compartments for the violins ten steps from the front of the orchestra but ask the bass viol player to walk through two swinging doors and clear to the other end of the building to reach the bass viol compartments. Also, if possible, locate the rehearsal rooms for these larger instruments near their playing location in the band or orchestra and near their storage compartments. The less the large instruments have to be carted around, the better for the insrtuments and for the disposition of the players and director.

Watch Your Temperatures. Don't store woodwinds, drums, violins and other string instruments in damp basements. Avoid placing them near radiators, hot air registers, or in hot attics or lofts. Strive for even temperature and humidity. A thermometer and humidity gauge are good investments. Try to maintain 72 degrees Fahrenheit and 50% humidity as closely as possible. Avoid placing string instruments and woodwinds against outside walls, as they are liable to be subjected to wide changes in temperature. Avoid storing brass instruments near the heating plant. Fumes from the furnace are liable to corrode and tarnish the instruments.

Handling on Trips. Much damage to instruments can be avoided by observing some simple rules on systematic handling. Assign to the band manager and his crew all the work of transporting instruments. Train this crew so they will learn to put the heavy instruments on the bottom and the lighter ones on top, so they will know what side or end of a trunk or case to face up in order to give greatest protection to the instrument, so they will know how to pack a truck or car with instrument cases or trunks that will ride with the least shifting around and scuffing against each other. When entire responsibility is placed in these "property men," traveling schedules will go more smoothly, fewer instruments will be left behind, and less damage will be done to them.

Repairing and Overhauling. No definite schedule can be laid down for repairing and overhauling instruments, for the treatment given them by different players and their quality of construction vary too much. In general, the solo instruments such as cornet, trumpet, B♭ clarinet, oboe, flute, alto or tenor saxophone, trombone, and French horn should be given a complete overhaul annually. The bass and harmony instruments, such as bass tuba, sousaphone, euphonium, alto horn, baritone horn, alto clarinet, bass clarinet, and bassoon, should be completely overhauled at least every two years. Some contend that *all* reed instruments, including alto and bass clarinet and bassoon, should be overhauled annually, and we do not disagree. Any schedule can be criticized from individual standpoints, and only very general and flexible recommendations can be laid down.

Necessary repairs should be taken care of at once. Keep the instrument in top playing condition. This will save overhauling charges and total amount of repairing, to say nothing about prolonging the life of the instrument. It is good practice to have instruments checked over and adjusted often. This prevents unnecessary wear, breakage, and major repair bills.

There are some Conn sousaphones still being played in a certain high school after 20 years of constant use. They are in first class condition. If you were to guess how long they have been in service, you might guess all the way from six months to two or three years. These instruments have had intensive usage but also have had excellent care. The players are instructed on how to take care of them and how to clean them and keep them in playing condition. They are sent to a repairman at the end of every school year for check-up and such overhauling as is needed. A good instrument's life depends a great deal upon the care it receives. The same instrument may last 5 years, 15 years, or 25 years, depending upon how it is treated and kept in repair.

SCHOOL BAND INSTRUMENT INVENTORY AND DEPRECIATION RECORD

Even the best of band instruments eventually wear out. Some wear out faster than others. To keep the band equipment up in first class condition, repairs must be made and old instruments must be replaced — not spasmodically but according to a well worked out system. In other words, to maintain the band instrument equipment it must be repaired and replaced at the same rate it wears out.

Business Management. Many bandmasters have difficulty obtaining money to maintain their band instrument equipment because they haven't put their department on a business basis. To hard-boiled superintendents and school board officials their presentation of needs has sounded unbusiness-like, too much like a letter to Santa Claus.

All well-managed businesses have a schedule of depreciation on equipment and a routine appropriation of money to replace the equipment at the same rate it wears out. This business-like handling prevents being caught without funds for needed equipment, prevents erratic and haphazard appropriations, levels out the hills and valleys in the appropriation curve, — is in short good management. The band instrument department needs such good management.

The Band Instrument Inventory and Depreciation Record is an important control in such good management. Once school authorities know that the amount of money asked for each year by the bandmaster is being budgeted on a business-like basis, backed by accepted accounting methods, much haggling and horse trading will be avoided. Fortified with the figures derived from this Depreciation Record, the bandmaster can approach school officials with much better standing and increased authority.

Proved Plan. Instead of being in the position of pleading for money with which to buy additional band instruments, the bandmaster simply informs school officials about the amount of money they must appropriate to protect their present investment and keep their school equipment in good working condition. This is information they want and is welcome. Furthermore, his figures are not guesswork, but are based on standard accounting methods approved by good management of all kinds. He, therefore, speaks with authority.

This entire plan was worked out after extensive consultation with the best authorities in the country, in the bandmaster field, school field and in the accounting field. It is based on the best experience obtainable. It is a thoroughly workable plan and we trust it will be put in use by bandmasters everywhere.

FOR COMPLETE INFORMATION ABOUT THIS PLAN, write Conn Band Instrument Division, C. G. Conn Ltd., Elkhart, Ind., and ask for bulletin "School Band Instrument Inventory and Depreciation Record."